



Spotter Training 2017



NWS Storm Survey
Creston – April 27, 2016

KCRG TV
Iowa Environmental Mesonet
Parkersburg - July 6, 2016





Outline

Part I

- Introduction
- Spotters in Warning Process
- Spotter Safety
- 2016 Iowa Weather Review
- Iowa Severe Weather Climatology
- Weather-Ready Nation Ambassador



Courtesy CBS News

Break

Part II

- Thunderstorm Fundamentals
- Updrafts & Downdrafts
- Tornadoes
- Quiz



Source Unknown





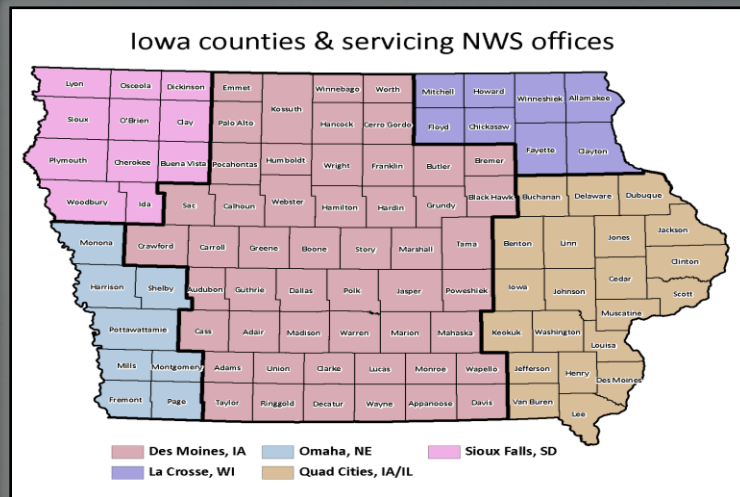
The National Weather Service

Who we Are...

Federal government
weather forecast agency

Who we Serve...

- United States & Territories
- Five Offices Serve Iowa



Primary Mission...

Provide weather warnings for the
protection of life and property

- 24/7 Operations
- Taxpayer Cost: \$3.45/year

**As a spotter, you help us
accomplish this mission!**





Warning Process

- Radar has limitations however, especially farther away from the site

City	Range (miles)	Beam Center Height (ft AGL)	Beamwidth (ft)
Ames	21	1,300	1,780
Fort Dodge	58	4,300	4,930
Ottumwa	84	7,786	7,200
Waterloo	87	7,914	7,500
Mason City	101	9,745	8,680

Remember that 1 statute mile = 5,280 ft

- The radar beam is often greater than a mile wide (low resolution)
- No spotter report may leave information from the surface to a mile or two aloft unknown





The Role of the Spotter

- Your reports provide information we can get nowhere else!
- Reports are used in real-time to help meteorologists issue warnings
- Spotter reports are immediately released to the world to increase the response to the threat





The Role of the Spotter

Do we always have enough reports to know what storms are producing? Unfortunately, no

- Tornadoes and wind blown large hail have gone through county seats unknown to the NWS until hours or even a day later.
- NEVER...feel like you're bothering us
- NEVER...think we already know about the storm. Even days later.
- Five duplicate reports are always better than none. We average < 1 spotter report per warning

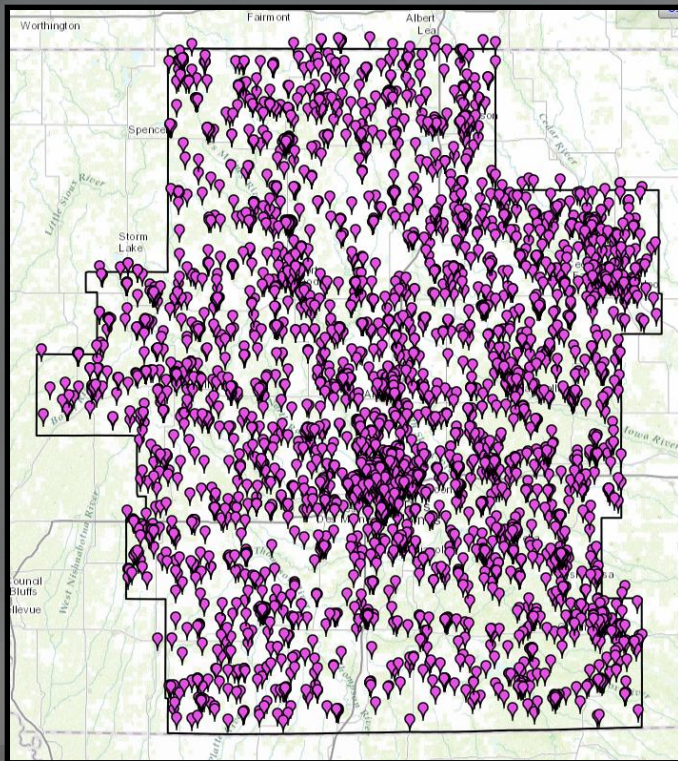


phillipmartin.info





The NWS Spotter Network



- Over 4,700 spotters and counting
- Contact the NWS directly with severe weather reports
- Spotters especially needed in rural areas

Interested in joining?
Register here or online!



Courtesy Kevin Skow





Other Types of Spotters



Local Fire/Police

Often report severe weather to dispatch, who then relays the report to the NWS.



Amateur Radio

Can be part of a net or independent.
Call sign for NWS Des Moines is **KØDMX**.



Storm Chasers

Cover large areas and chase for a hobby. Can send out video/photos in real-time online.



Other Types of Spotters

NWS Cooperative Observer Program

- Volunteer civic minded citizens or businesses send temperature & precipitation reports every day
- Equipment provided at no cost
- Official observations go on US Climate Record
- <http://www.nws.noaa.gov/om/coop/>





Other Types of Spotters

Volunteers currently needed at...

- Bloomfield (Davis Co)
- Britt (Hancock Co)
- Corning (Adams Co)
- Davis City (Decatur Co)
- Harcourt (Webster Co)
- Hubbard (Hardin Co)
- Jefferson (Greene Co)
- Leon (Decatur Co)
- Ottumwa (Wapello Co)
- Shell Rock (Butler Co)
- Promise City (Wayne Co)



For more information:

- brad.fillbach@noaa.gov
- 800-759-9276





How to Report to the NWS

- **Phone call**
800-759-9276 (SKY-WARN)
- **Amateur Radio (KØDMX)**
Amateur radio operators only
- **Social Media**
Facebook, Twitter, Periscope
- **Text Messaging**
- **E-mail**
- **Online Reporting Form**



Courtesy Extreme Instability



Courtesy Extreme Instability





Social Media

How to Report to the NWS



Facebook (NWS Des Moines)

- Post reports, photos & videos directly on our page



Twitter (@NWSDesMoines)

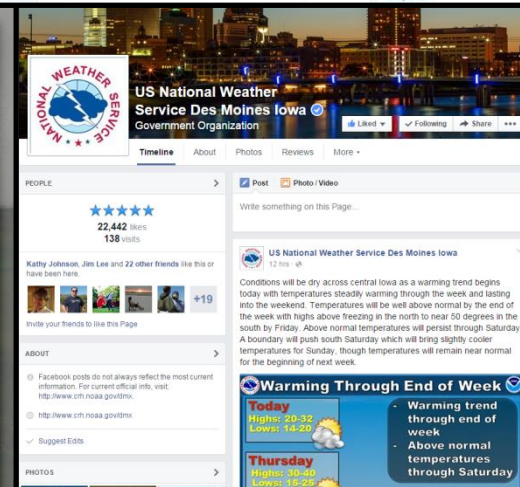
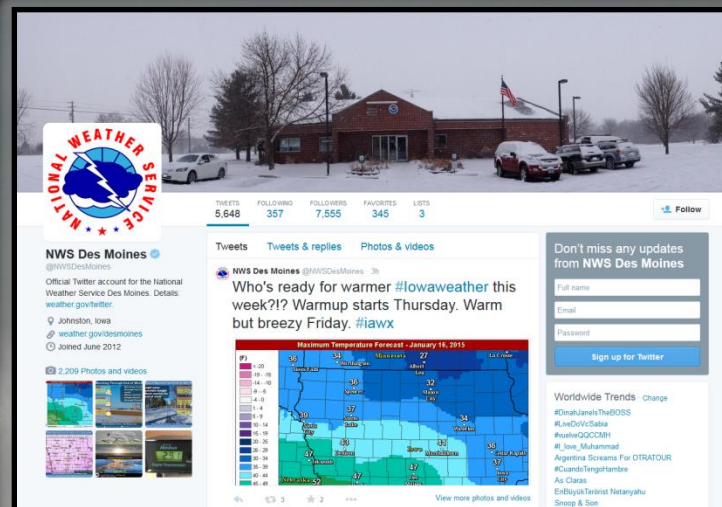
- Send reports directly to us
- Add #nwsdmx or #iawx



Periscope (NWS Des Moines)

- Send live video to Twitter with #nwsdmx or #iawx added to broadcast title

We encourage everyone to like and follow the NWS on Facebook and Twitter!





Text Messaging and Email

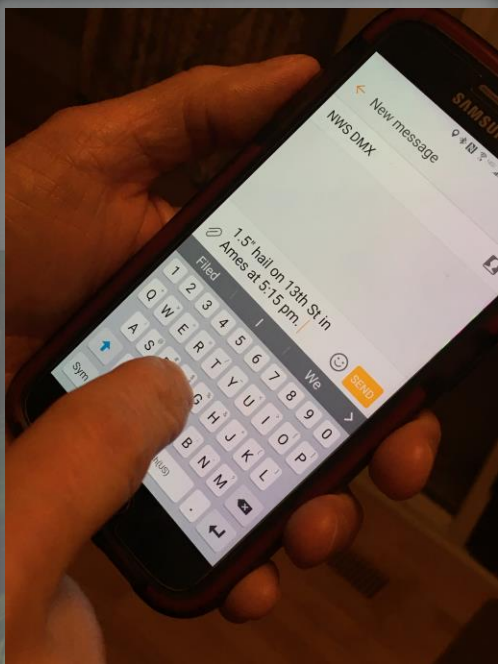
How to Report to the NWS

- Text Messaging
(515) 240-5515
- E-mail
dmx.spotterreport@noaa.gov

Remember!

Regardless of method,
always include...

- **Time/Date**
- **Location**
- **Details**



Pictures say a 1000 words. We love photos and video! Send via text or email.





Online Reporting Form

How to Report to the NWS

This form is available
on our website at:
weather.gov/desmoines

Go to the “Current Hazards”
menu and click
“Submit a Storm Report”

The form will guide you on
what information to report

The screenshot shows the 'Submit a Storm Report' form for the National Weather Service Des Moines, Iowa. The form is titled 'Submit a Storm Report to the National Weather Service Des Moines, Iowa'. It includes a 'Local detailed forecast by "City, ST" or ZIP code' field with a 'Go' button. Below this is a disclaimer: 'This interface is intended to be used solely for the relay of storm information to the NWS. Other comments or information should be sent to the National Weather Service Des Moines, Iowa.' The form is divided into four sections: 1. Event Location, 2. Event Type, 3. Additional Details, and 4. Contact Information. Section 1 includes fields for Date, Time, and Place, with a map of Iowa for location selection. Section 2 lists event types such as Dense Fog, Flood, Hail, High Wind Speed, Tornado/Funnel Cloud, Wind Damage, Snow, Freezing Rain/Icing, and Heavy Rain. Section 3 provides a text area for additional details. Section 4 includes fields for Your Name, Spotter ID, E-mail address, and Phone number, along with an Observer Profile dropdown. At the bottom, there are 'Review Report' and 'Reset Report' buttons, and a note: 'NOTE: If you have any questions about reporting weather and/or using this reporting form, please contact the DMK Watershed.'

NWS Storm Report Home Now - About Contact

NATIONAL WEATHER SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Submit a
Storm Report
to the National Weather Service Des Moines,
Iowa

Local detailed forecast by "City, ST" or ZIP
code
Enter location **Go**

This interface is intended to be used solely for the relay of storm information to the NWS. Other comments or information should be sent to the National Weather Service Des Moines, Iowa.

1. Event Location
Enter date/time/location of event. Please reference to major roadway or intersection for events within townships.

Date: Jan 28 2017
Time: 06:45 PM * Central
Place: --Select a County-- Location (see: NWS Mytown)
Unable to perform automatic geolocation.
Error Message: [Geolocation permission denied]

2. Event Type (Select all that apply)

- Dense Fog
- Flood
- Hail
- High Wind Speed
- Tornado/Funnel Cloud
- Wind Damage
- Snow
- Freezing Rain/Icing
- Heavy Rain

3. Additional Details
Provide any additional information that you feel is pertinent to your submission (500 characters maximum).

You may also pass along additional information by e-mailing them to the National Weather Service Des Moines, Iowa separately. (WFO DMX)

4. Contact Information
VOLUNTARY and **WILL NOT** be distributed.

Your Name: Spotter ID (if assigned): E-mail address: Phone number:

Observer Profile:
(General Public)

Review Report **Reset Report**

NOTE: If you have any questions about reporting weather and/or using this reporting form, please contact the DMK Watershed.



What to Report

Who?	Spotter number/source
What?	What are you seeing? Use proper terms
Where?	Reference the nearest city, street, or lat./lon.
When?	Time of event (if in the past)
Damage?	Be descriptive

Be as specific as possible!

Spotty hail or hail covering the ground? Several trees damaged or trees down all across town? Water standing or flowing? How deep?





Tornadoes

What to Report

- **Rotating Wall Clouds**
- **Funnel Clouds**
 - How far down to the ground?
- **Tornadoes**
 - Can you see rotation in the cloud?
 - Any dust or debris below the funnel?
 - How far away is tornado?
(estimate the distance and direction)
 - Speed & motion of the tornado?
 - Size of the tornado? Is it changing?
(getting larger, roping out, etc.)
 - Damage, injuries, or deaths?

Courtesy KWWL



Courtesy KCCI uLocal



Courtesy Glenn Thorne





Hail

What to Report

Report all hail, regardless of size

- Measure the **diameter** of the hailstone
- If you can't measure the hail, compare to common coin or ball sizes
 - **Do not report marble-sized hail!**
- Report the size of the largest hailstone you measure (and the average size if possible)

Diameter	Description
1/4"	Pea
1/2"	Dime
3/4"	Penny
1"	Quarter
1.25"	Half Dollar
1.50"	Ping Pong

Diameter	Description
1.75"	Golf Ball
2"	Hen Egg
2.50"	Tennis Ball
2.75"	Baseball
3"	Tea Cup
4"	Grapefruit



Courtesy Jessica Varno



Flickr

What Size are Your Marbles?



Damaging Winds

What to Report

- **Wind Strength**
 - Measured or estimate
- **Tree damage**
 - Size of tree limbs snapped off
 - How widespread is the damage?
 - Trees trunks snapped or uprooted?
 - Was the tree old or rotten?
- **Building damage**
 - Due to wind or trees falling onto the building?
- How long did the winds last?
- What direction was the debris blown?
 - Debris all blown the same direction?



Photos Courtesy
KCCI uLocal





Flash Flooding

What to Report

- What is being impacted?
 - Roads, houses, farm fields, etc.
- Water Depth? (estimate)
- Is the water **standing still** or **flowing**?
- How often does this location flood?
- How much rain has fallen at your place during the storm?
 - How quickly did the rain fall?





What to Report

Can't remember
all of this?

Don't Worry!



Reporting Severe Weather

Reporting severe weather is essential! Remember that each report, regardless of the method, must include the time and location of the event. Pictures tell a thousand words, but not when and where the weather occurred!

How to Report:

Online: [Use our online weather reporting form!](#) For reporting tornadoes, please use our 1-800-SKYWARN telephone line.

Email: dmx.spotterreport@noaa.gov - A great way to include pictures and/or video.

SMS Text Messaging: (515) 240-5515 - Send your phone pictures and text messages to this number with time, date, and location information. With pictures, include a bit of text describing the direction you are looking.

Telephone: 1 (800) SKYWARN - Must have been through severe weather spotter training and belong to a spotter network to use this line! Refer to materials received during spotter training.

Facebook: Visit our [Facebook](#) page and post a severe weather report to our wall.

Twitter - Send Twitter reports to the National Weather Service by including the #iawx hashtag.

Amateur Radio - The National Weather Service group amateur radio call-sign is KØDMX.

All of this information is
on our **handout** or at
weather.gov/desmoines
on the **Storm Spotting**
menu link





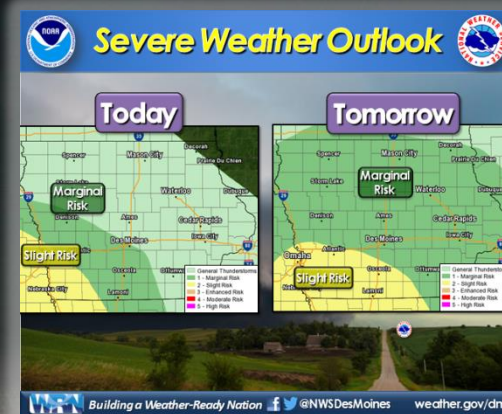
Spotter Information

Staying Informed

Weather Story

www.weather.gov/desmoines

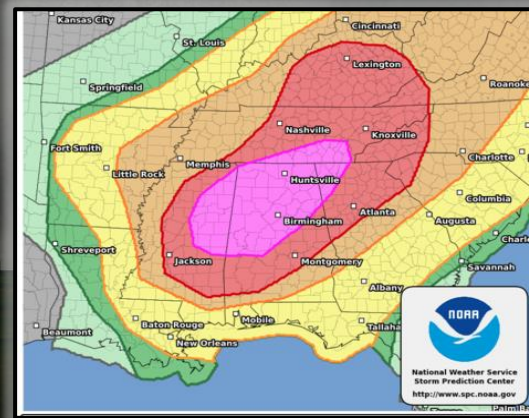
Highlights the most significant weather in the next few days in central Iowa



Severe Weather Outlooks

www.spc.noaa.gov

National outlooks issued by the SPC for the upcoming three days



None Gen Storms Marginal Slight Enhanced Moderate High

Risk for Severe Weather







Days Ahead of the Event

Staying Informed



Understanding Severe Thunderstorm Risk Categories

THUNDERSTORMS (no label)	1 - MARGINAL (MRGL)	2 - SLIGHT (SLGT)	3 - ENHANCED (ENH)	4 - MODERATE (MDT)	5 - HIGH (HIGH)
No severe* thunderstorms expected	Isolated severe thunderstorms possible	Scattered severe storms possible	Numerous severe storms possible	Widespread severe storms likely	Widespread severe storms expected
Lightning/flooding threats exist with <u>all</u> thunderstorms	Limited in duration and/or coverage and/or intensity	Short-lived and/or not widespread, isolated intense storms possible	More persistent and/or widespread, a few intense	Long-lived, widespread and intense	Long-lived, very widespread and particularly intense
					
<ul style="list-style-type: none"> Winds to 40 mph Small hail 	<ul style="list-style-type: none"> Winds 40-60 mph Hail up to 1" Low tornado risk 	<ul style="list-style-type: none"> One or two tornadoes Reports of strong winds/wind damage Hail ~1", isolated 2" 	<ul style="list-style-type: none"> A few tornadoes Several reports of wind damage Damaging hail, 1 - 2" 	<ul style="list-style-type: none"> Strong tornadoes Widespread wind damage Destructive hail, 2" + 	<ul style="list-style-type: none"> Tornado outbreak Derecho

* NWS defines a severe thunderstorm as measured wind gusts to at least 58 mph, and/or hail to at least one inch in diameter, and/or a tornado. All thunderstorm categories imply lightning and the potential for flooding. Categories are also tied to the probability of a severe weather event within 25 miles of your location.





Severe Weather Watches

Staying Informed

Watch the Skies

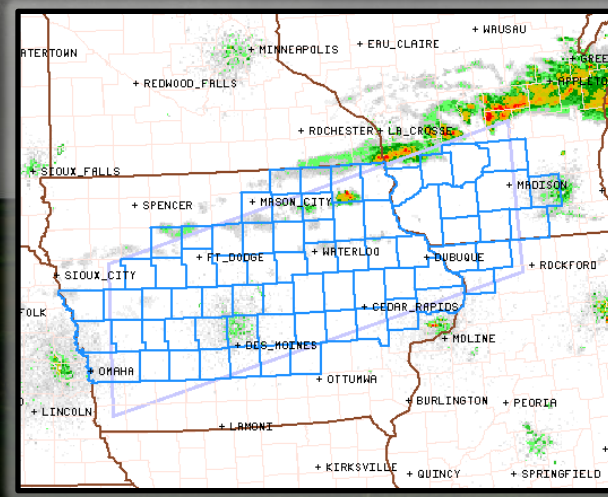
- Issued when *conditions are favorable* for the development of severe weather
- In effect for 4 to 6 hours and cover large areas of the state

Types of Watches:

Tornado Watch

Severe Thunderstorm Watch

Flash Flood Watch





Severe Weather Warnings

Staying Informed

Take Action Now!

- Means severe weather is occurring or expect to occur very shortly
- Seek shelter now!
- The warning polygon is issued for the specific storm or threat

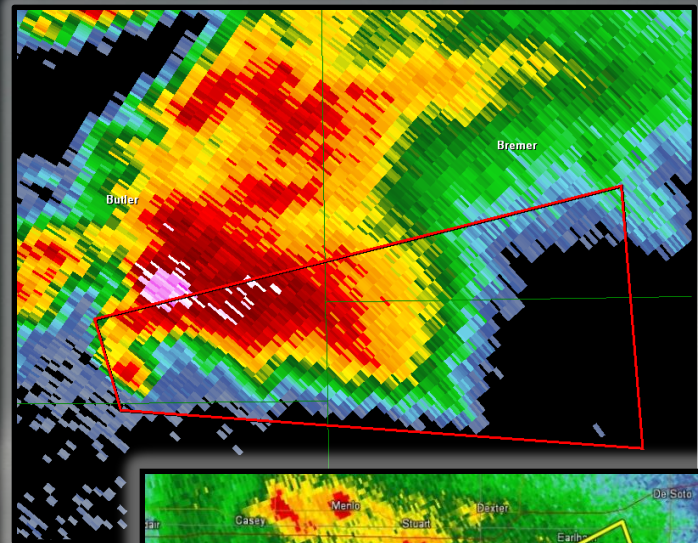
Types of Warnings:

Tornado Warning

Severe Thunderstorm Warning

Hail $\geq 1"$, Winds ≥ 58 mph, Beyond minor tree or structure damage

Flash Flood Warning





Severe Weather Warning Text

Staying Informed

Warning text describes impacts and uses “tags” to make important information easier to find

THE NATIONAL WEATHER SERVICE IN SPRINGFIELD HAS ISSUED A
* TORNADO WARNING FOR...
NORTHWESTERN NEWTON COUNTY IN SOUTHWEST MISSOURI...
SOUTHEASTERN CHEROKEE COUNTY IN SOUTHEAST KANSAS...
SOUTHWESTERN JASPER COUNTY IN SOUTHWEST MISSOURI...
THIS INCLUDES THE CITY OF JOPLIN...
* UNTIL 600 PM CDT.

* AT 514 PM CDT...A TORNADO EMERGENCY FOR THE CITY OF JOPLIN.
A CONFIRMED LARGE AND DESTRUCTIVE TORNADO WAS LOCATED NEAR
BAXTER SPRINGS MOVING NORTHEAST AT 40 MPH.

THIS IS A PARTICULARLY DANGEROUS SITUATION.
HAZARD...DEADLY TORNADO AND BASEBALL SIZE HAIL
SOURCE...SPOTTERS AND LAW ENFORCEMENT CONFIRMED TORNADO.
SIGNIFICANT DAMAGE TO HOMES REPORTED IN THE OAKS
SUBDIVISION.

IMPACT...LIFE THREATENING SITUATION. EXTENSIVE DAMAGE TO HOMES
AND BUILDINGS...UPROOTED TREES AND DEBRIS WILL
RESTRICT ACCESS INTO MANY AREAS.

* OTHER LOCATIONS IN THE WARNING...JOPLIN.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
IF YOU ARE IN OR NEAR JOPLIN TAKE COVER IMMEDIATELY!
&&
LAT...LON 3716 9479 3707 9426 3697 9430 3701 9479
TIME...MOT...LOC 2216Z 247DEG 36KT 3708 9470

TORNADO...OBSERVED
TORNADO DAMAGE THREAT...CATASTROPHIC
HAIL...2.75IN

Tornado Warning Tag

TORNADO...RADAR INDICATED	Evidence on radar is supportive of a tornado, but there is no ground confirmation.
TORNADO...OBSERVED	Tornado is confirmed by spotters, law enforcement, etc.

Tornado Warning Damage Threat Tag

No Tag	Used most of the time when tornado damage is possible.
TORNADO DAMAGE THREAT...CONSIDERABLE	Used rarely when there is credible evidence that a tornado is capable of producing considerable damage.
TORNADO DAMAGE THREAT...CATASTROPHIC	Used exceedingly rarely when a severe threat to human life and catastrophic damage from a tornado is occurring.

Tornado Tag In Severe Thunderstorm Warnings

TORNADO...POSSIBLE	A severe thunderstorm has some potential to produce a tornado
---------------------------	---

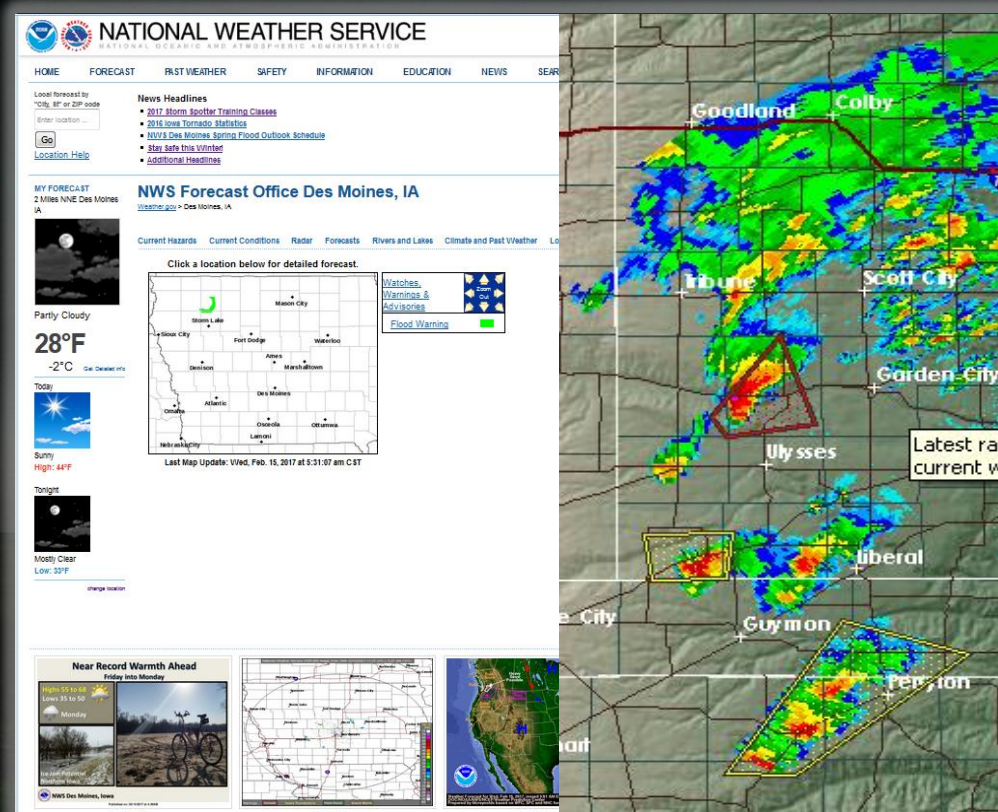




National Weather Service Website

Staying Informed

www.weather.gov/desmoines



“One Stop Shop”

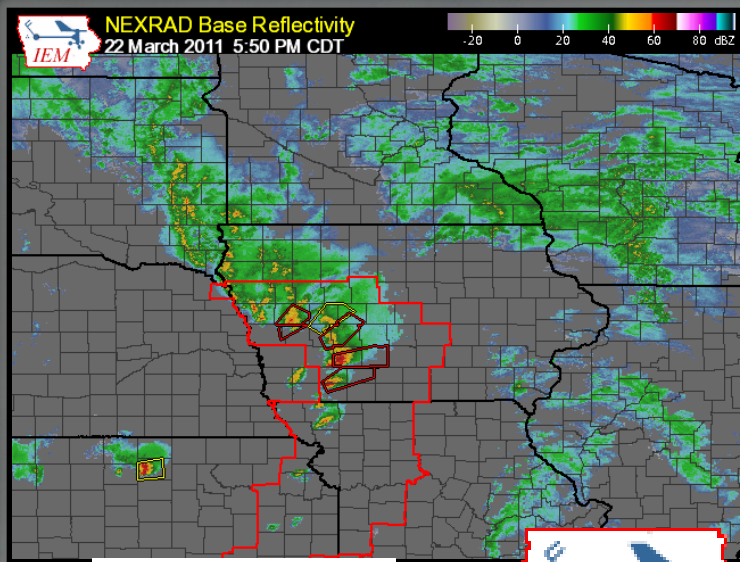
- Access to all outlooks, watches, and warnings
 - Submit spotter reports
 - Can view radar data with warning polygons
 - Seven day forecast
- ...and much more





Third Party Websites

Staying Informed



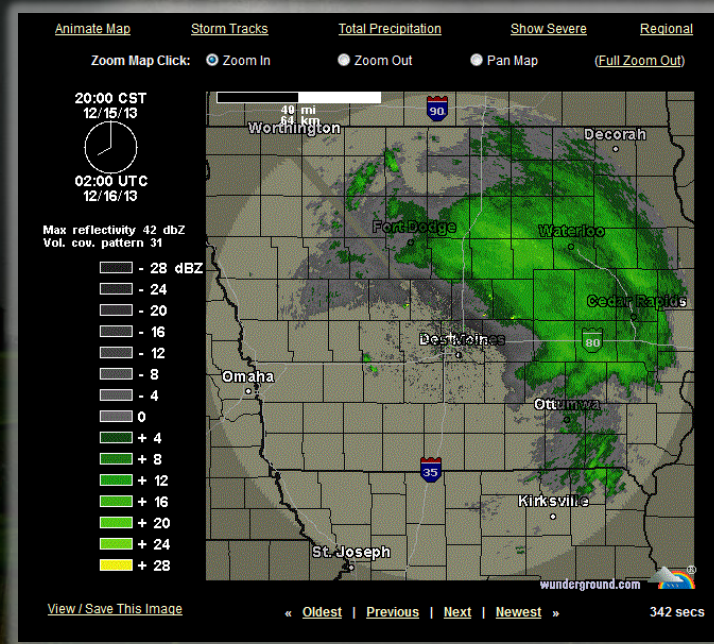
WEATHER
UNDERGROUND



AccuWeather

The
Weather
Channel

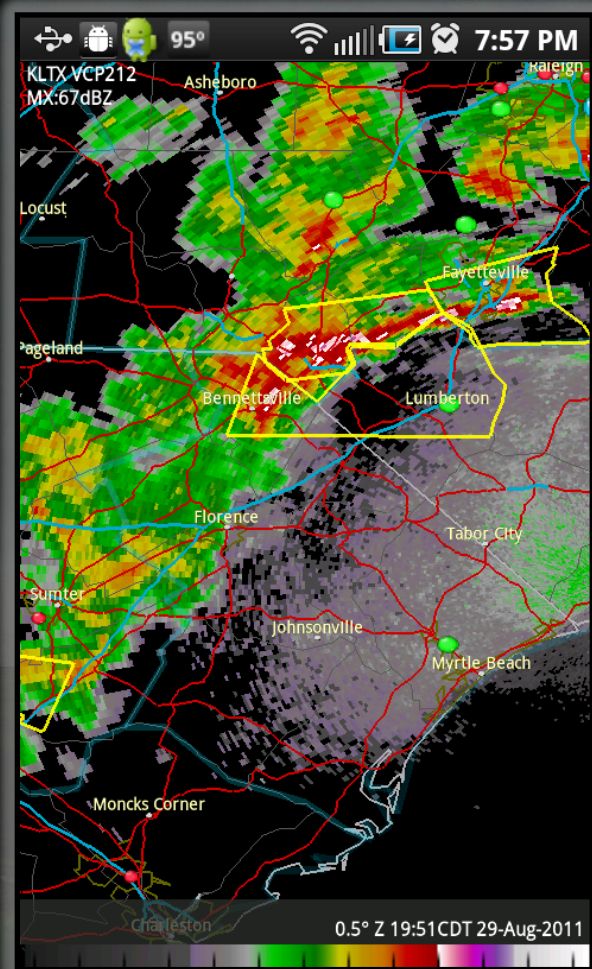
Dozens of third party sites
that display warning and
radar information





Smartphone Apps

Staying Informed



- Many apps available that provide current conditions, weather forecasts, radar data, and warnings for your location
- **Wireless Emergency Alerts (WEA)**
 - Tornado and flash flood warnings
- Several powerful radar apps:
 - **RadarScope** – iPhone and Android
 - **PYKL3** – Android only

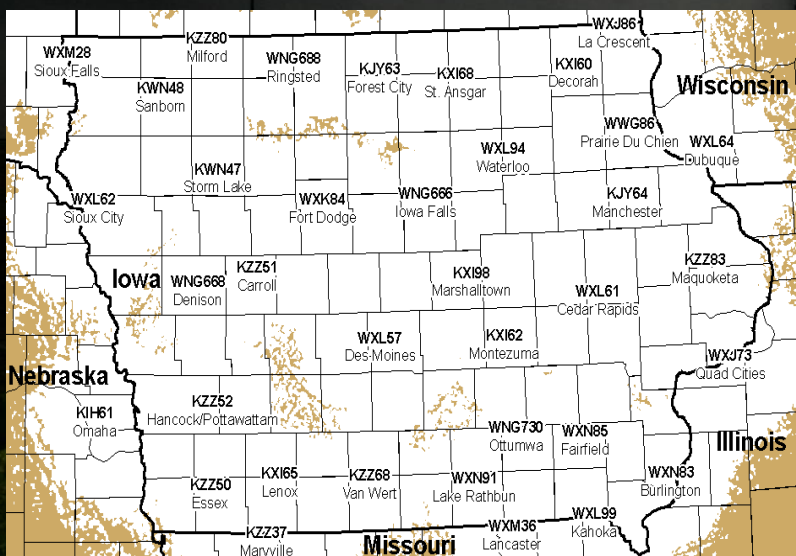


NOAA Weather Radio

Staying Informed



- Operated by the NWS and broadcasts weather forecasts and warnings 24/7
- Coverage over most of Iowa
- Need a special radio receiver
- Can program the radio to only alert for certain counties

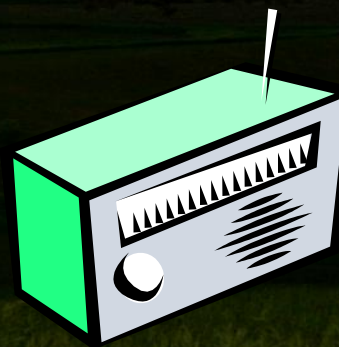




Television and Radio

Staying Informed

- Radio stations will interrupt their programming to broadcast watches and warnings
- TV stations usually place a crawl at the bottom of the screen with the watch/warning information
 - Often will interrupt programming if the storm is heading towards a highly populated area





Additional Resources

- **Online Spotter Resource Page**
See handout- online courses and excellent printable spotter guides

- **Advanced Spotter Training**

Ready for the next step?

March 7, 6:30 PM — ISU (Ames)

Agronomy Hall — Room 3140

April 24, 7:00 PM — UNI (Cedar Falls)

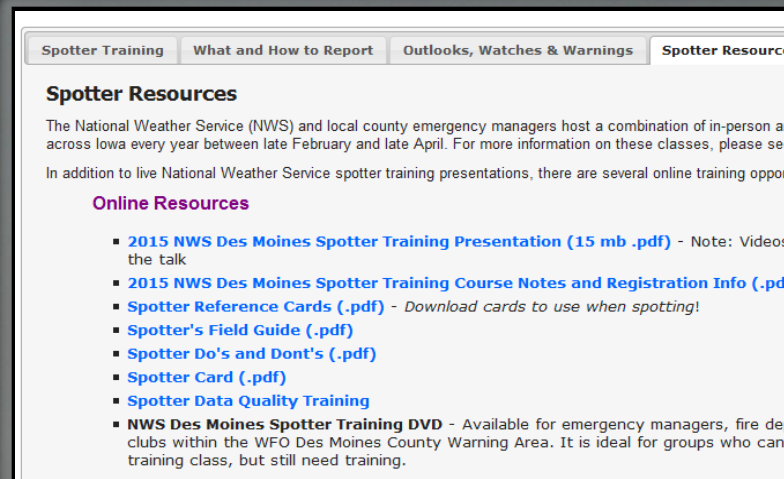
Latham Hall — Room 125

- **Spotter Webinars**

April 4, 7:00 PM

April 11, 7:00 PM

www.weather.gov/desmoines





Spotter Safety



Tornadoes

Lightning



Strong Winds



Hail



Flash Flooding





Tornadoes

Spotter Safety



Courtesy Severe Studios, Inc

- **Maintain situational awareness at ALL times**
 - Avoid “tunnel vision”
- **ALWAYS** have an escape route
- Seek a sturdy structure if you are in danger
- **Avoid night spotting**
 - Hard to see anything
 - Very dangerous!
- If your car is struck by even a weak tornado, your life is in danger!





Tornadoes — Night Spotting

Spotter Safety



Source Unknown





Tornadoes — Vehicle Safety

Spotter Safety



Cars, trucks & SUVs
are NOT safe!



Underpasses are
NOT safe!





Tornadoes — Vehicle Safety

Spotter Safety



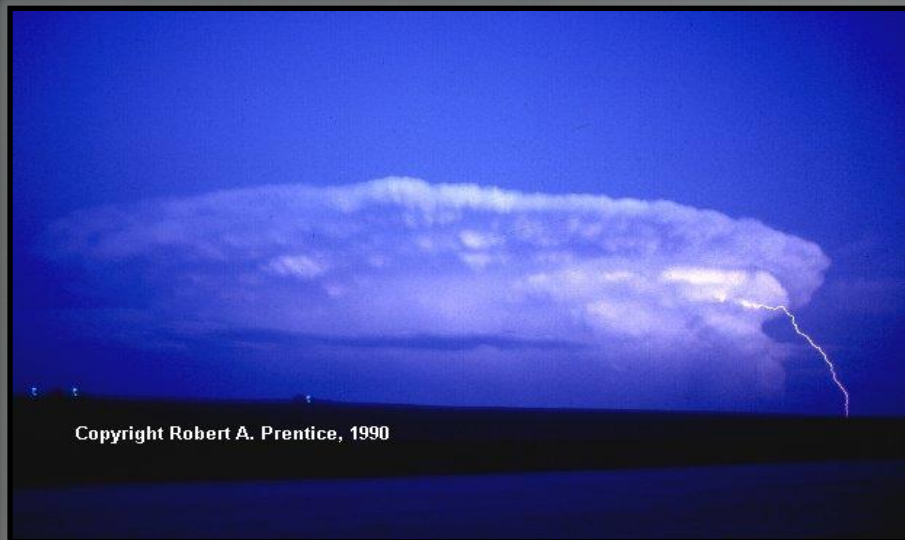
Still Not Convinced?



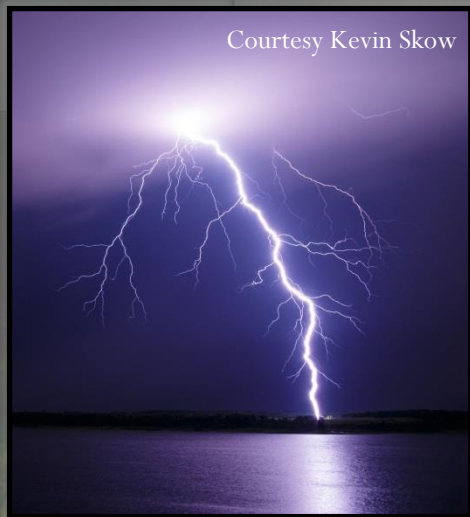


Lightning

Spotter Safety



Copyright Robert A. Prentice, 1990



Courtesy Kevin Skow



- Lightning is by far the most common hazard facing spotters
- Be careful on ridge tops and open areas
- Stay in vehicle if mobile
- Tires don't protect you, the vehicle frame does!

**Hear thunder?
You are at risk!**



Strong Winds

Spotter Safety



YouTube Video by user mconwxdr



- Frequent with squall lines, but can occur with any type of storm
- Often on the storm's leading edge
 - However, can travel far from the actual storm
- **Do not** seek shelter under trees or in small structures that might collapse!





Hail

Spotter Safety



- Hail can fall at speeds of over **100 mph!**
- Even small hail can cause damage and injury
- Take shelter in a walled structure and stay away from windows
- Wind-driven hail is very dangerous and destructive





Flash Flooding

Spotter Safety



- The #1 severe weather-related killer in the US!
- Heavy rainfall combined with saturated soils
- Impacts amplified by terrain or poor drainage (e.g. cities)



Remember:
Turn around, don't drown!





Spotter Safety

Your SAFETY is our #1 concern!



Keep an eye to the sky

Prepare for all hazards

Watch for flooding & lightning

Drive smart & safely

Use common sense



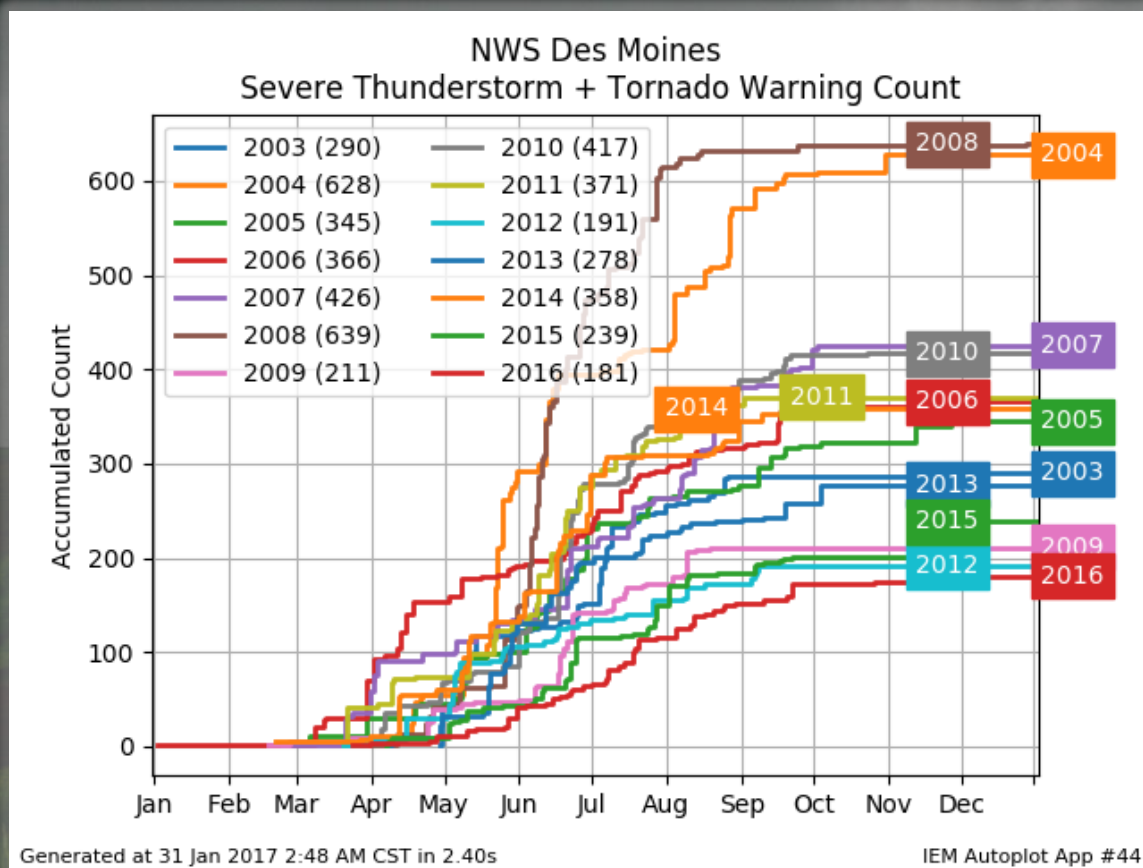
Remember, the National Weather Service does not “officially” deploy spotters. Spotting is done at one’s own risk!





Iowa 2016 Severe Weather

- Relatively inactive
- NWS Des Moines issued the lowest number of combined Severe Thunderstorm & Tornado Warnings since at least 2003





Iowa 2016 Tornadoes

43 tornadoes, 12 injuries, 0 deaths (32 EF0, 9 EF1, 2 EF2)

- July 17: EF2s hit Benton and Linn Counties (9 injuries)
- Unusual late November tornadoes in central Iowa
- All tornadoes in NWS Des Moines area were EF0 (17)



Randall Olson



Iowa 2016 Wind

A few of Iowa's significant events:

July 6: High winds across northern Iowa. Railcars blown off track near Manly.

July 13: Afternoon storms produced tree and building damage near Oskaloosa.



[View original](#)

KWWL TV

KWWL Storm Track 7 @KWWLStormTrack7
Strong winds blowing rail cars off the track in Manly last night. By Brad Hunsicker. #kwwlwx #iowa pic.twitter.com/U8znPQEYUJ



Russ Jergens



KCCI TV ulocal

July 7: Tree damage in Rolfe





Iowa 2016 Floods

- Record Flooding along the Shell Rock River
 - Shell Rock @ Shell Rock
 - Shell Rock @ Rockford
 - Boone River @ Goldfield



Courtesy Kip Ladage



Courtesy Steve Kramer

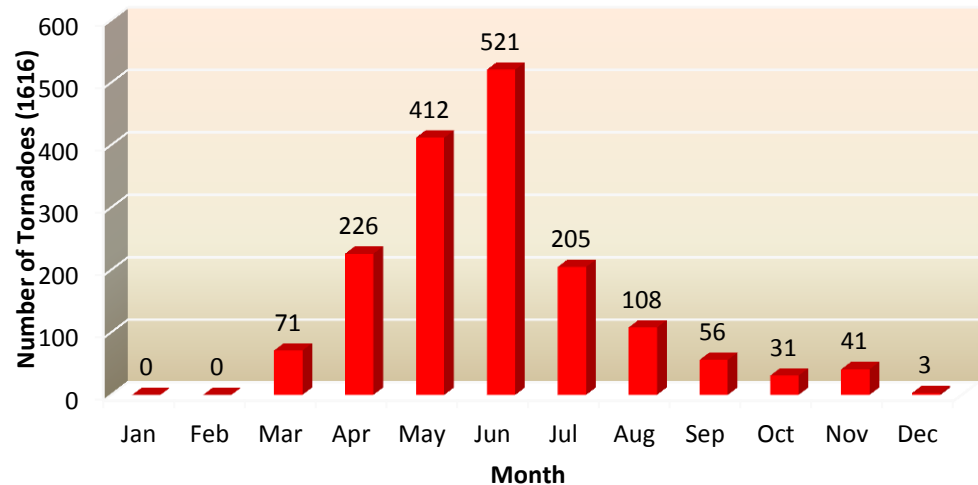


Iowa Tornado Climatology

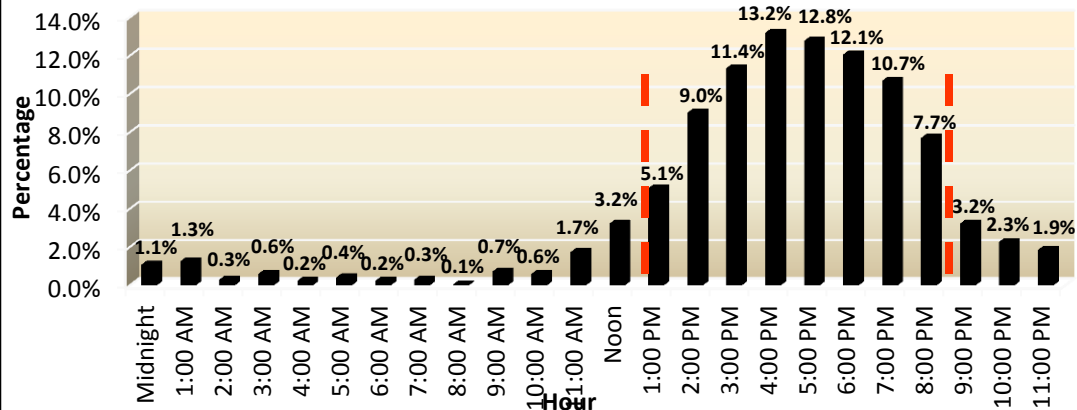
By Year:

- Average: 48
- Activity peaks in May and June
- Every month has seen a tornado

1980 - 2015 Tornadoes by Month



Percentage of Tornadoes by Time of Day (CST)



By Time:

- Most tornadoes occur between 1 & 8 PM
- Minimum at night
- However, can occur at any time of day!

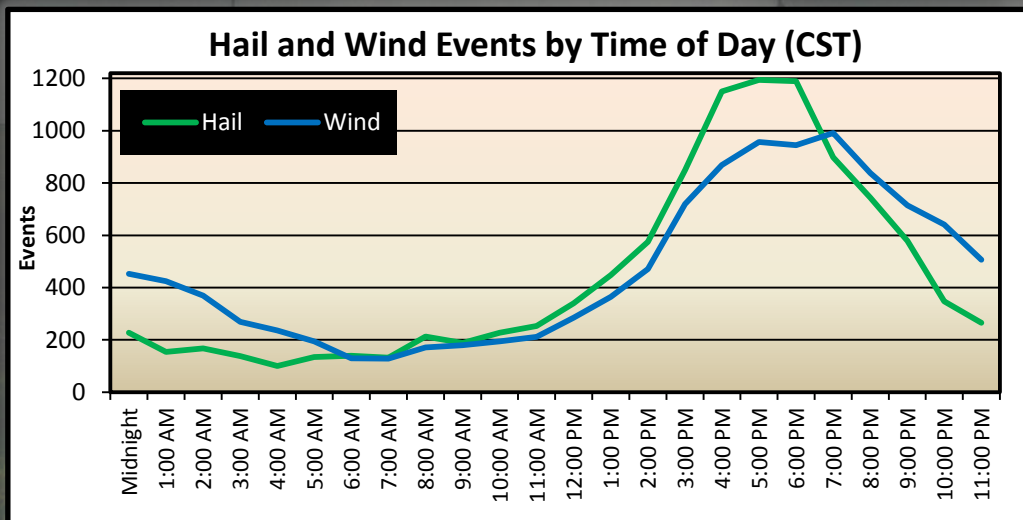
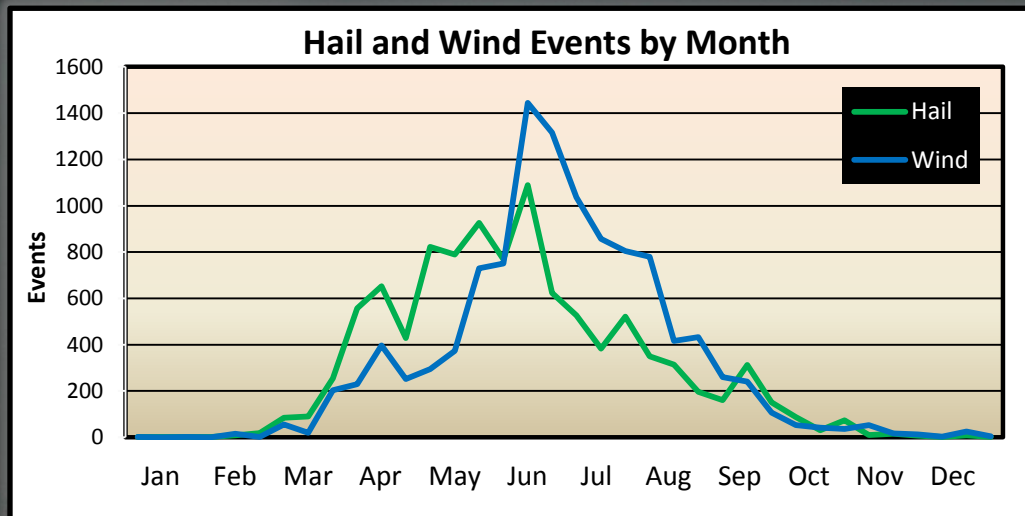




Iowa Hail & Wind Climatology

By Month:

- Peak Threat for Hail:
Spring – Early Summer
- Peak Threat for Wind:
Late Spring – Summer
- Occasional events into fall



By Time:

- Peak Time for Hail:
Afternoon Hours
- Peak Time for Wind:
Mid Afternoon – Early Morning





Weather-Ready Nation Ambassador

Weather-Ready Nation Ambassador:

- Free NWS partnership program for organizations and businesses (over 4,500)
- Serve as an example by educating members or employees on workplace preparedness
- Engage with NWS on collaboration opportunities
- Promote Weather-Ready Nation preparedness by sharing quarterly preparedness newsletters



To Become a WRN Ambassador

- Fill out short form during break





BREAK TIME!

~~Part I: Spotter Basics~~

NOW  10 minute break

Take this time to enter the following contact info into your phone. This needs to be at your fingertips!

Voice: 800-759-9276 (800-SKYWARN)

Text: 515-240-5515

Email: dmx.spotterreport@noaa.gov

Part II Coming up:

Thunderstorm & Tornado Basics





Outline

Part I

- Introduction
- Spotters in Warning Process
- Spotter Safety
- 2016 Iowa Weather Review
- Iowa Severe Weather Climatology
- Weather Radio National Ambassadors



Courtesy CBS News

Break

Part II

- Thunderstorm Fundamentals
- Updrafts & Downdrafts
- Tornadoes
- Quiz



Source Unknown





Thunderstorm Fundamentals



Thunderstorm
Ingredients
Thunderstorm
Lifecycle



Courtesy Gene Rhoden





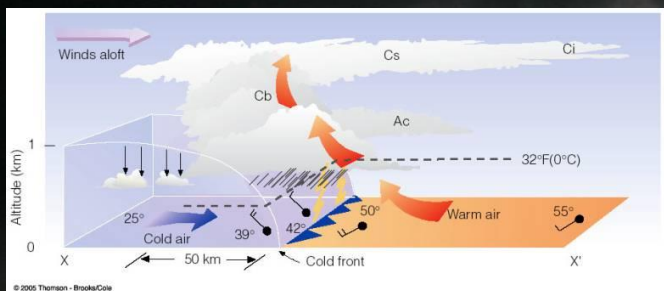
Thunderstorm Ingredients



- **Moisture**

Forms clouds and precipitation

Common source: Gulf of Mexico



- **Lift**

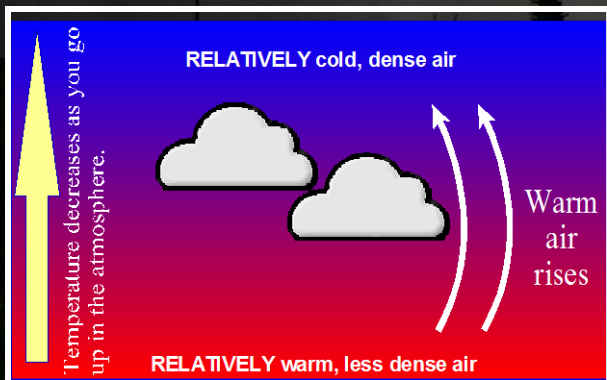
Mechanism that forces air to rise

Common source: weather fronts

- **Instability**

Necessary for a storm's updrafts to grow

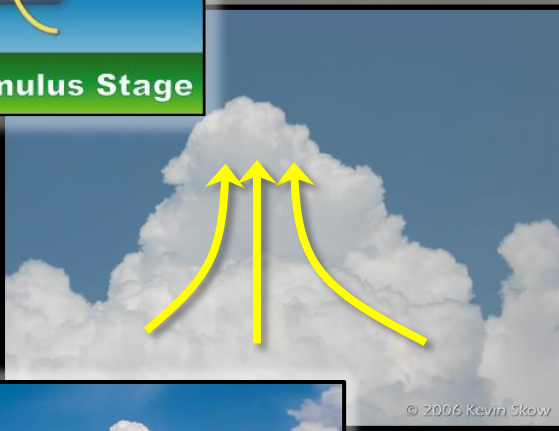
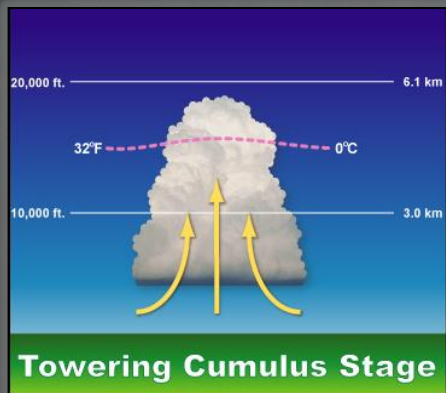
Example: Warmer (lighter) air under colder (heavier) air





Stage 1: Development Stage

Thunderstorm Lifecycle



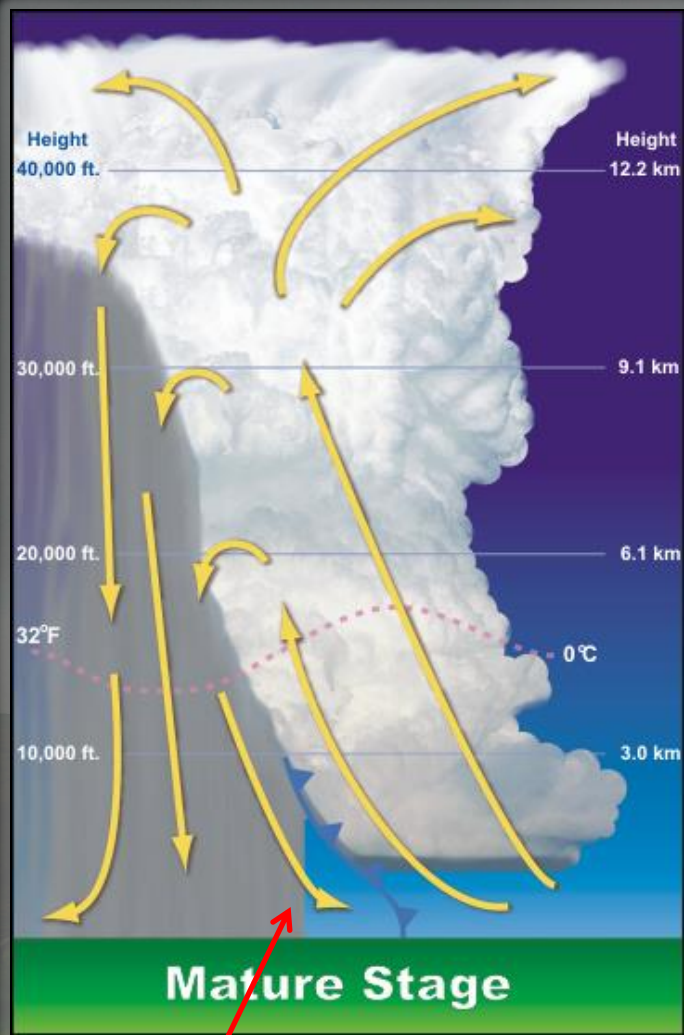
Images Courtesy
Kevin Skow

- Air rises, cools, and condenses into cumulus clouds
- The rising air is known as the storm's **updraft**
- Cloud droplets collide, grow larger, and descend towards the ground
- These falling drops form the storm's **downdraft**, and the storm enters Stage 2



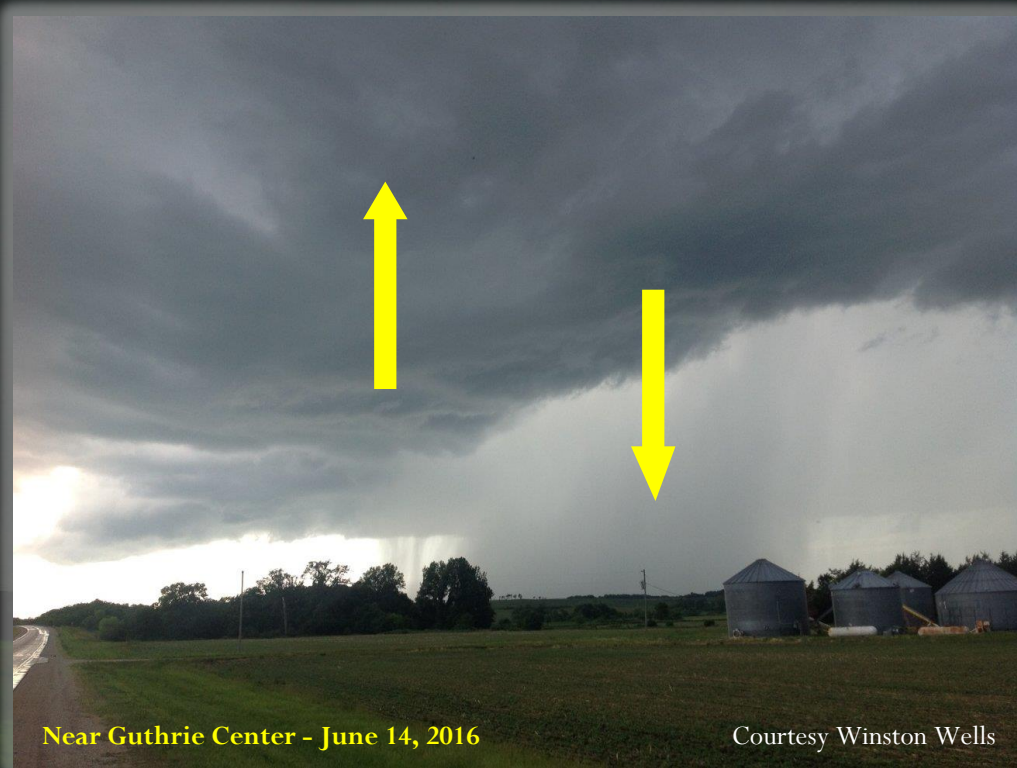
Stage 2: Mature Stage

Thunderstorm Lifecycle



Action Area

Updraft and downdraft coexist



Most important stage & when
the majority of severe weather
occurs

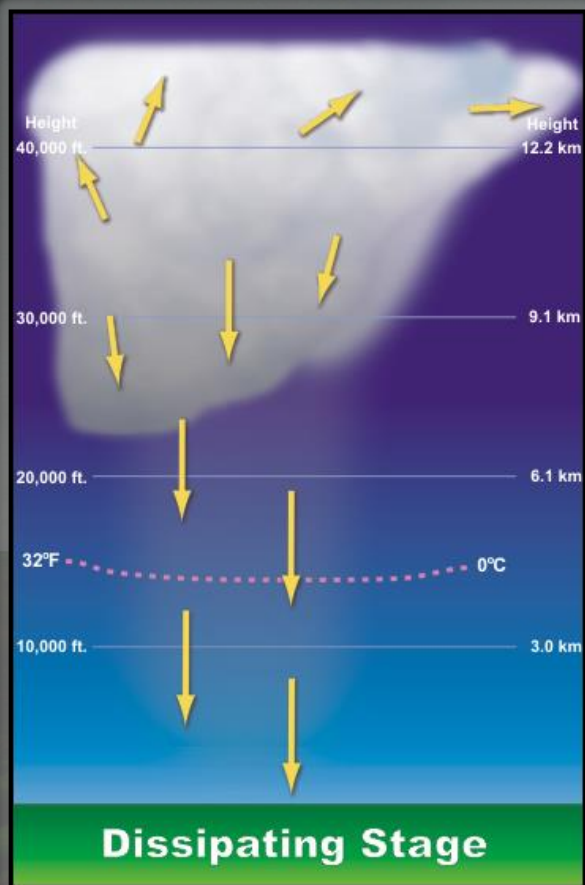




Stage 3: Dissipating Stage

Thunderstorm Lifecycle

Downdraft cuts off the storm updraft, storm begins to dissipate



Courtesy Kevin Skow

**Severe weather threat
decreases rapidly in this stage**





Lifecycle Time-Lapse Video



Courtesy of the
Iowa Environmental
Mesonet

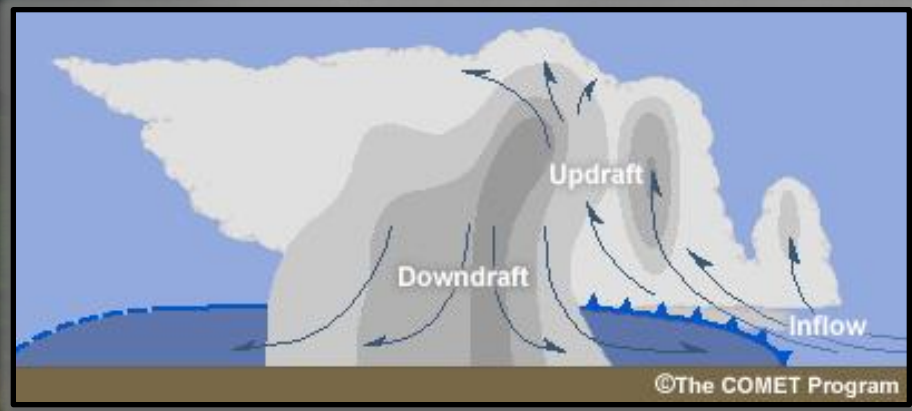
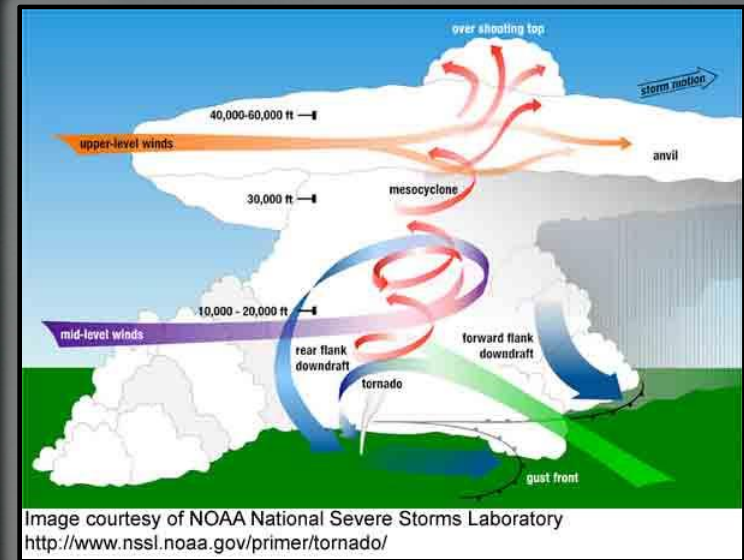
A thunderstorm undergoing all three lifecycle stages
This storm lasted about 40 minutes





Updrafts and Downdrafts

- Rotating Updrafts (Supercells)
- Updraft and Downdraft Locations
 - Rear/Southern Flank Updrafts
 - Front/Leading Edge





Rotating Updrafts / Supercells



Courtesy of Chris Conoan

Wayne Co – September 19, 2016

Supercell: An often dangerous storm consisting of a single, quasi-steady **rotating** updraft. Typically lasts longer than 10-20 minutes. If uncertain after watching for a bit, it probably isn't rotating

Rotating updrafts/supercells can lead to the production of very large (2+ inch) hail and violent (EF2-EF5) tornadoes.





Updraft/Downdraft Locations

Spotters need to identify updraft and downdraft locations. Updrafts can essentially be grouped into two basic areas.

Rear Flank Updrafts



Courtesy Rob Koppert

Discrete Cells

Front Flank Updrafts



Courtesy Kevin Skow

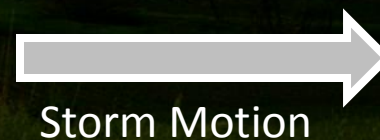
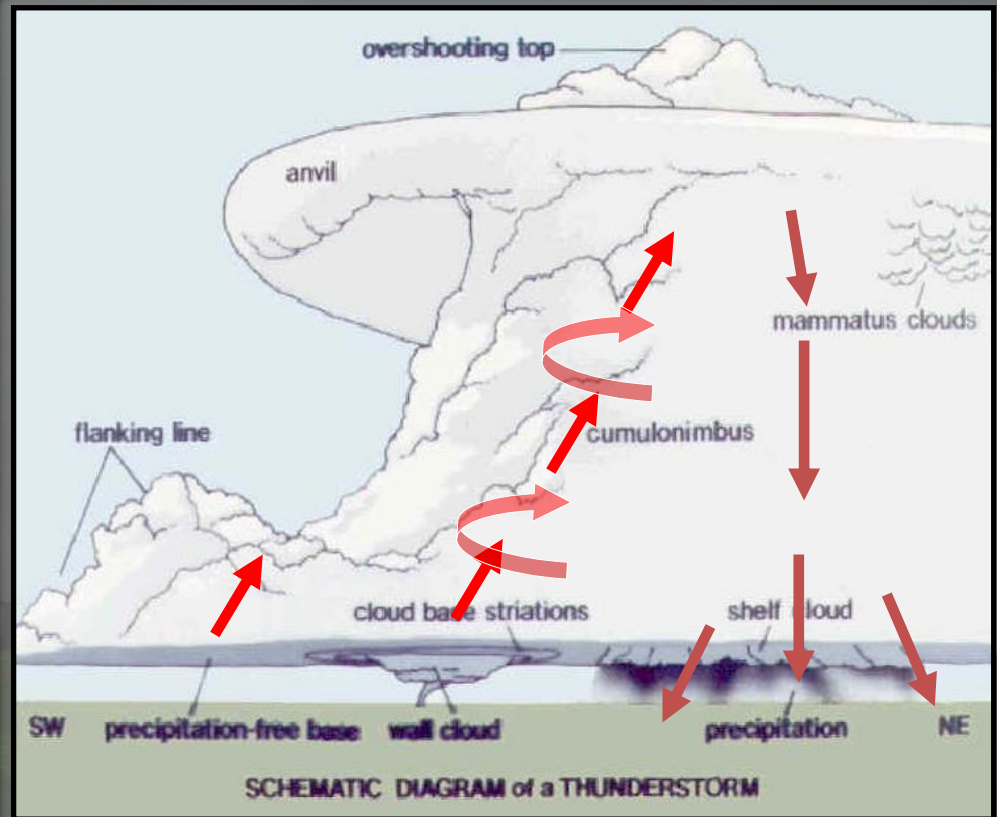
Multi-cells/Squall Lines





Rear/Southern Updrafts

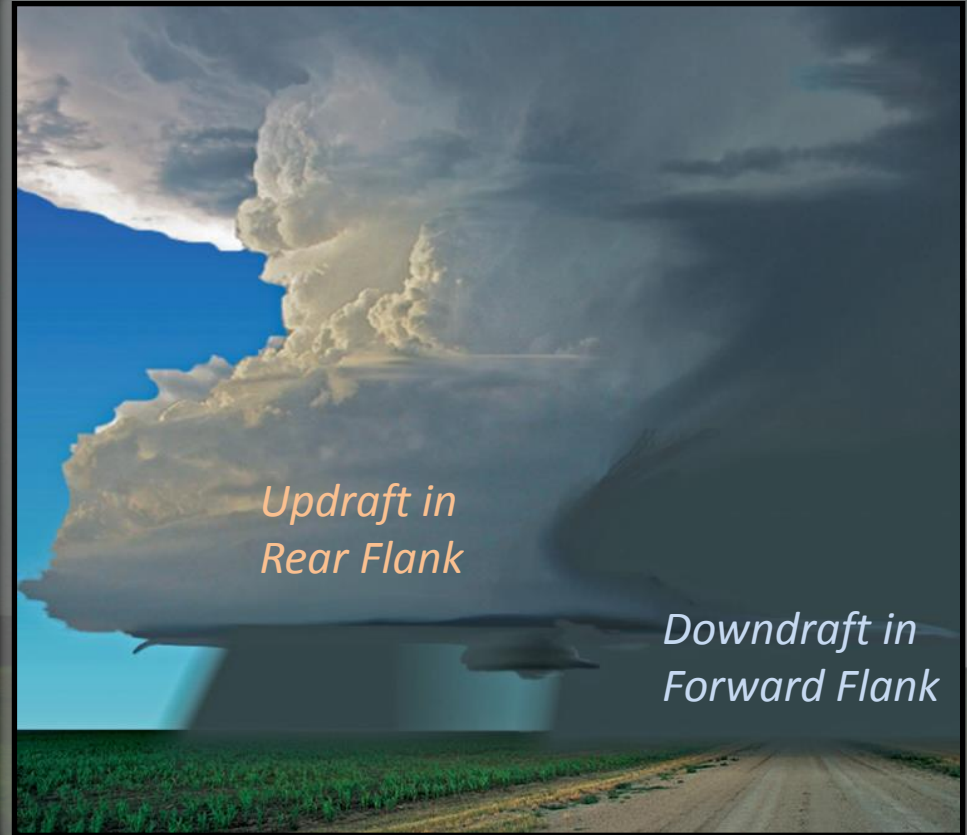
- Typically more discrete or isolated cells
- Storm can be slow or fast moving
- Downdraft toward the front of the storm
- Updrafts can be rotating (Supercell)





Rear/Southern Updrafts

- Large, flat updraft base
- Heavy rain in the forward region of the storm
- Large hail possible near updraft/downdraft interface
- Updraft tower often readily apparent



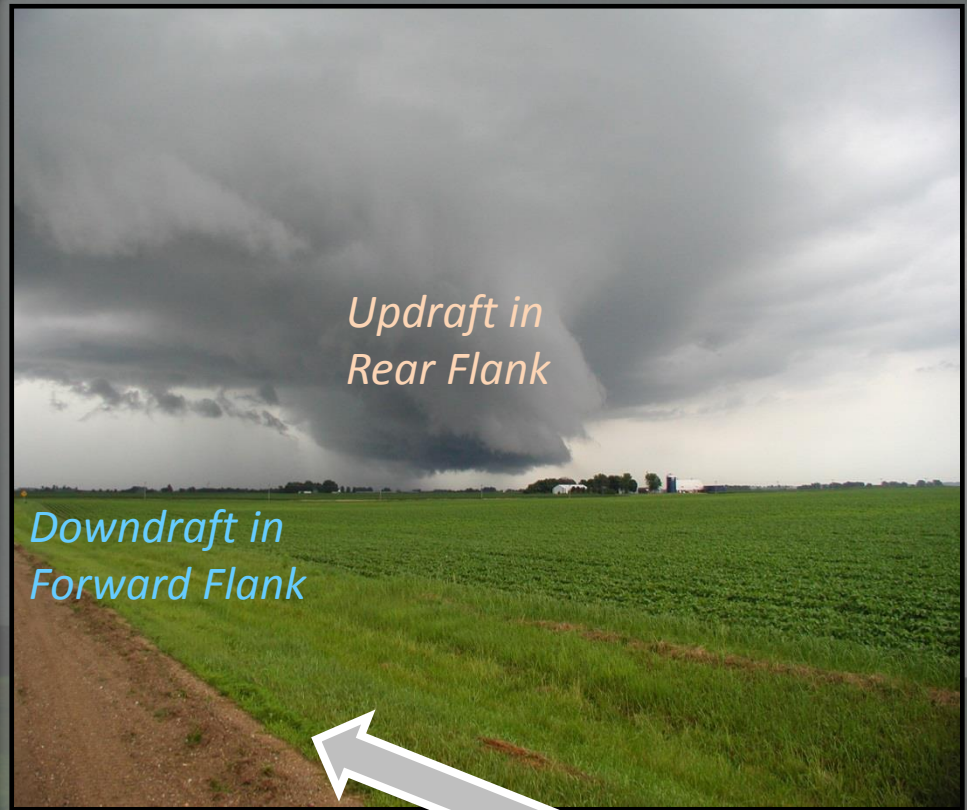
Movement Left to Right





Rear/Southern Updrafts

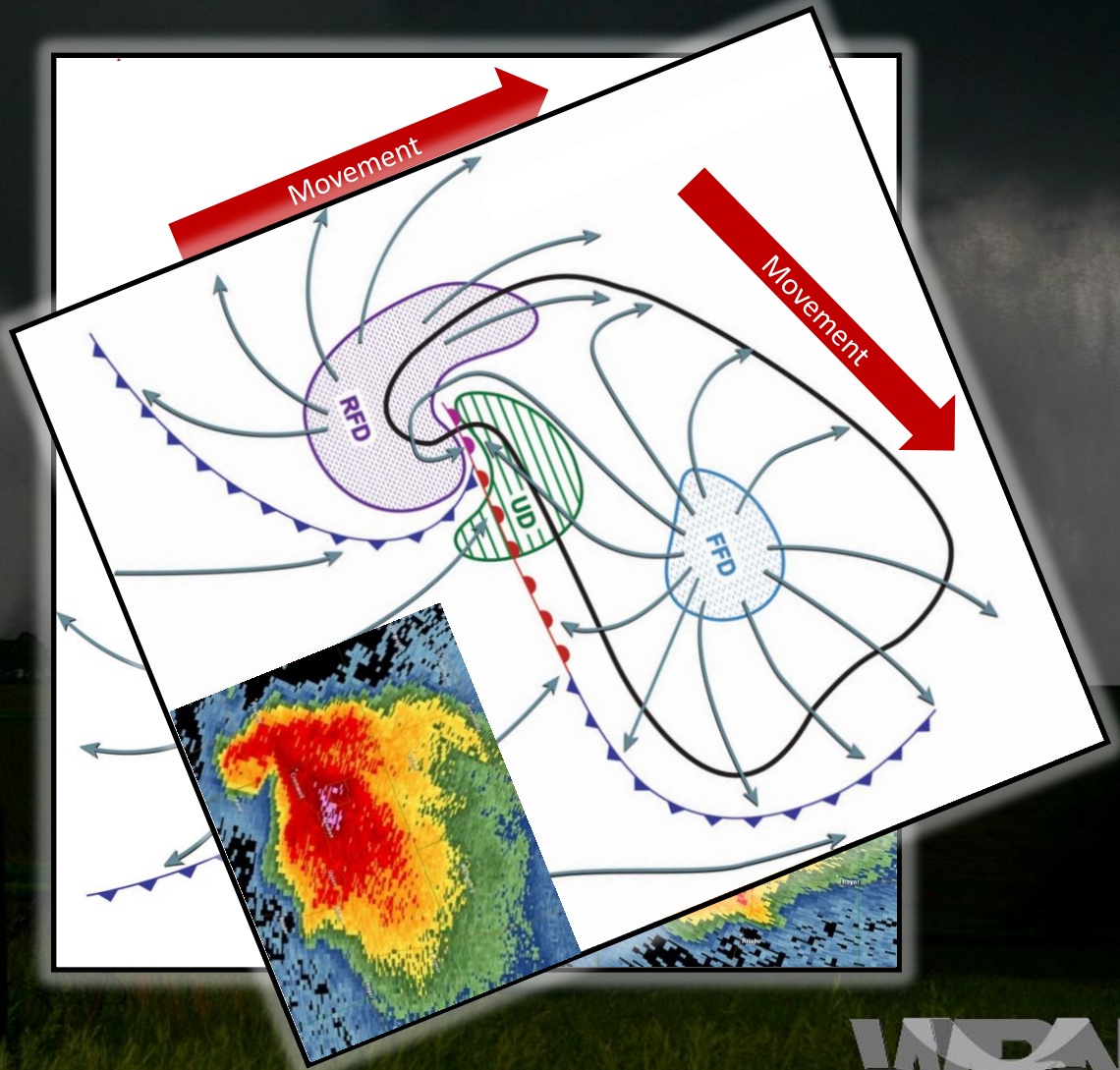
- Large, flat updraft base
- Heavy rain in the forward region of the storm
- Large hail possible near updraft/downdraft interface
- Updraft tower often readily apparent





Rear/Southern Updrafts

- Rear flank is often on the south or west, but rear portion is the emphasis.
- The storm could be moving towards the southeast, northwest, or anywhere in between!

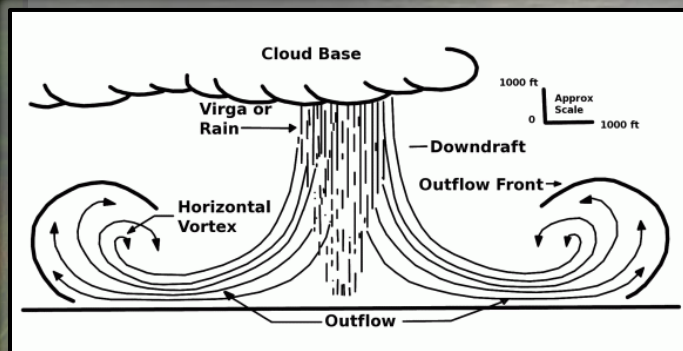




Leading Downdraft

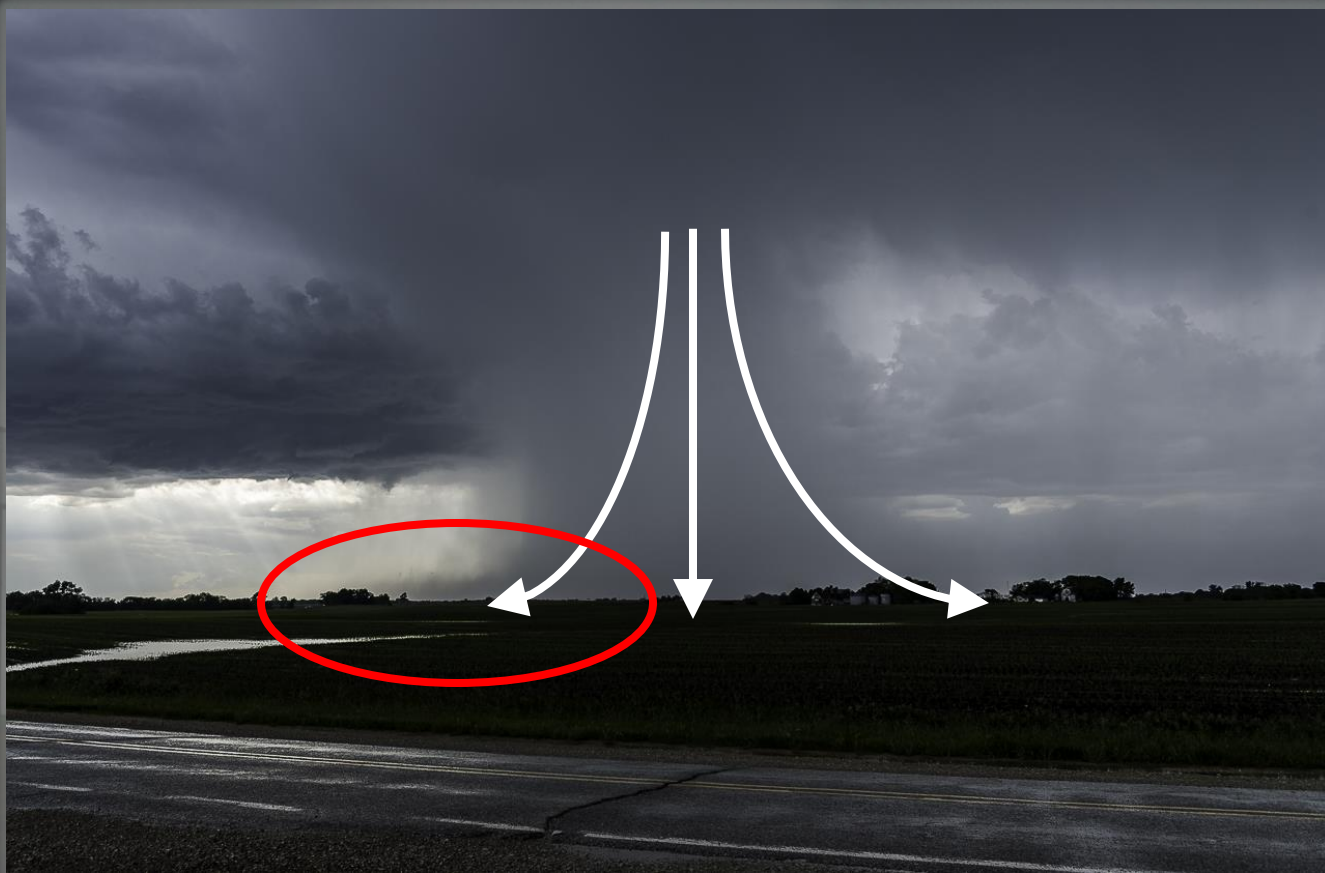
- Even weak storms can produce localized damaging winds called a microburst.
- Caused by a leading, small-scale downdraft that hits the ground and spreads outward.
- Winds can exceed 80 mph.
- Only a few square miles in size. Lasts ≈ 5 mins.
- Difficult to detect on radar.

Lake Panorama – September 10, 2013





Signs of a Potential Microburst



Near Minburn, IA – May 30, 2016

Rain Foot

Courtesy Willard Sharp – intothemseo.com

A pronounced outward deflection of the precipitation
near the ground





Forward Flank Updrafts



Squall Line

HP Supercell



@2015 Winston Wells

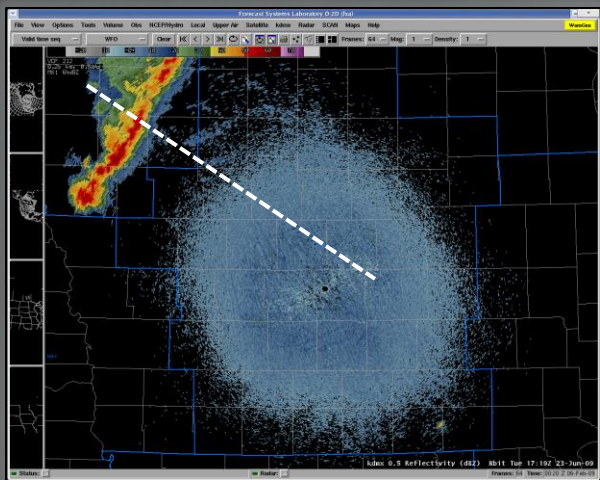
Courtesy Winston Wells



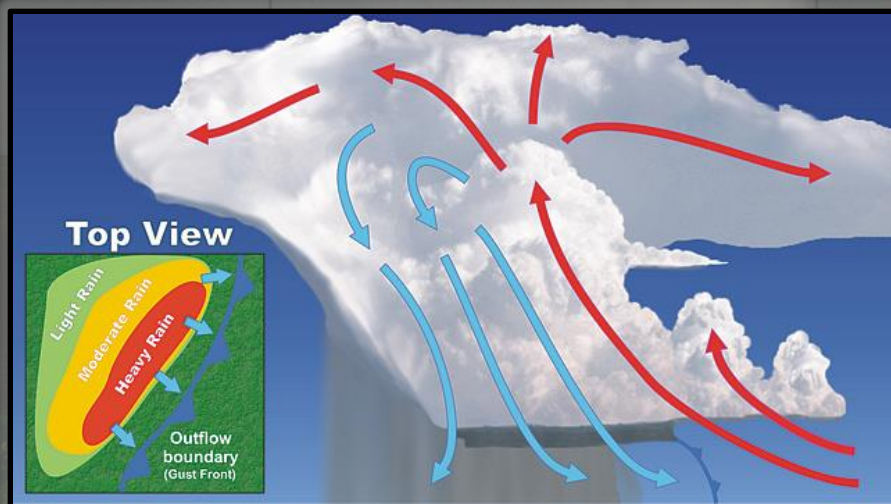


Squall Lines

Forward Flank Updrafts



- A “line” of storms where the individual downdrafts merge together, also known as a **squall line**
- The leading edge of this continuous downdraft is called the **gust front**
- The gust front produces a signature cloud known as a **shelf cloud**
- Typically form along frontal boundaries



Squall Line Cross Section





Squall Lines

Forward Flank Updrafts

Shelf Cloud



Earling, IA – July 7, 2016

Courtesy Willard Sharp – intothemeso.com

- Often associated with squall lines, but can occur with individual storms regardless of updraft position.
- Located on the leading edge of the line, or near gust front. Updraft above.
- Long, flat cloud which slopes down, away from the rain

No Vertical Rotation





Time Lapse of a Squall Line

Forward Flank Updrafts



Vinton
September 9, 2016

Courtesy
KCRG TV &
Iowa Environmental Mesonet

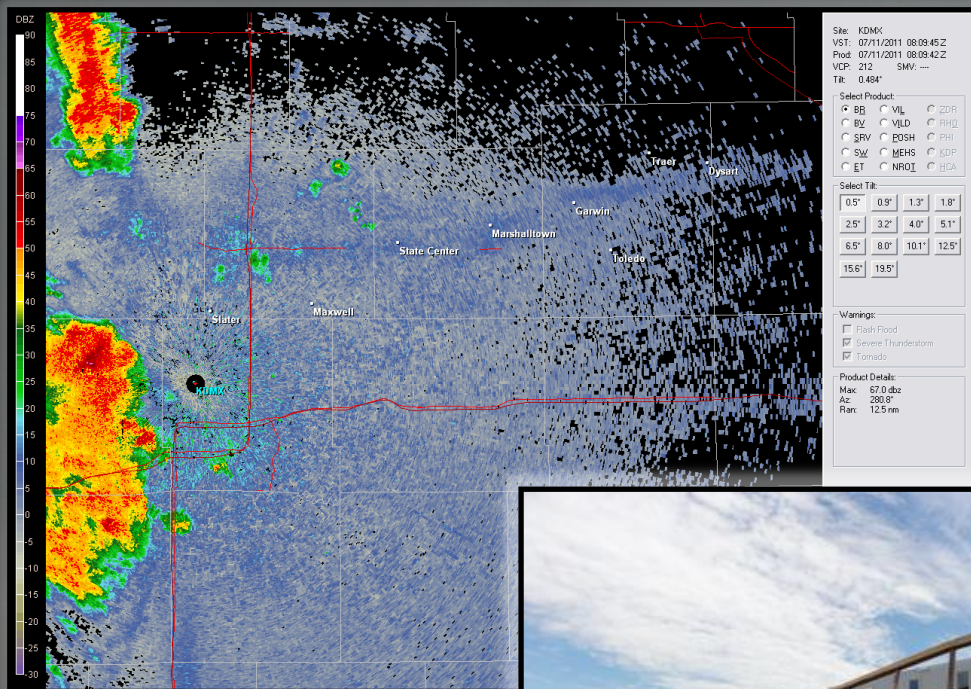
Shelf Cloud slopes downward, away from distant rain. Note lack of vertical rotation





Squall Line Hazards

Forward Flank Updrafts



Widespread Damaging Winds

- Moderate sized hail
- Heavy rain
- Occasional tornadoes

**East Iowa Derecho
July 11, 2011**





Forward Flank Updrafts



HP Supercell

- Rotating updraft on the front of the storm
- Heavy rain often obscures wall clouds and tornadoes
- Common in Iowa!



**Artist Rendition of the Front of an
HP Supercell**



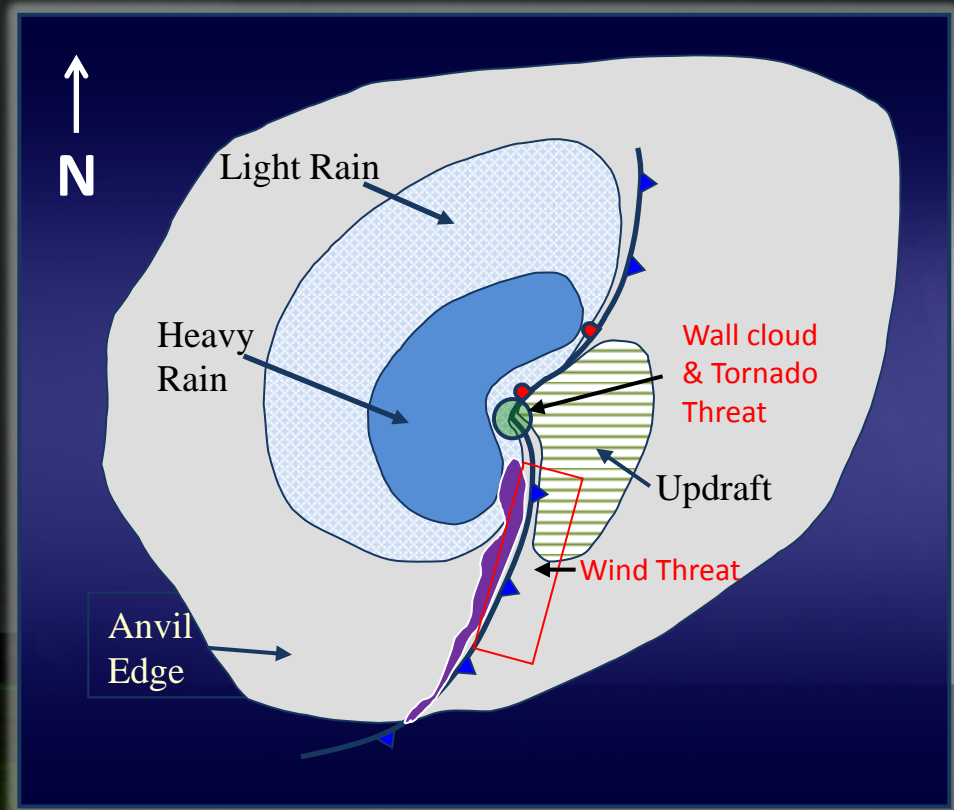


High Precipitation Supercells

Forward Flank Updrafts

- Large updraft in front of storm
- May have a shelf cloud along the gust front
- Extremely heavy rain may cause flash flooding
- Tornadoes may be hidden in the rain

HP Supercells can often transition to squall lines



**High Precipitation
Supercell Diagram**





High Precipitation Supercells

Forward Flank Updrafts



Courtesy of Tim Jones



Courtesy of Al Moller

**Note the Shelf Cloud
along the Gust Front**

High Precipitation Supercell Examples





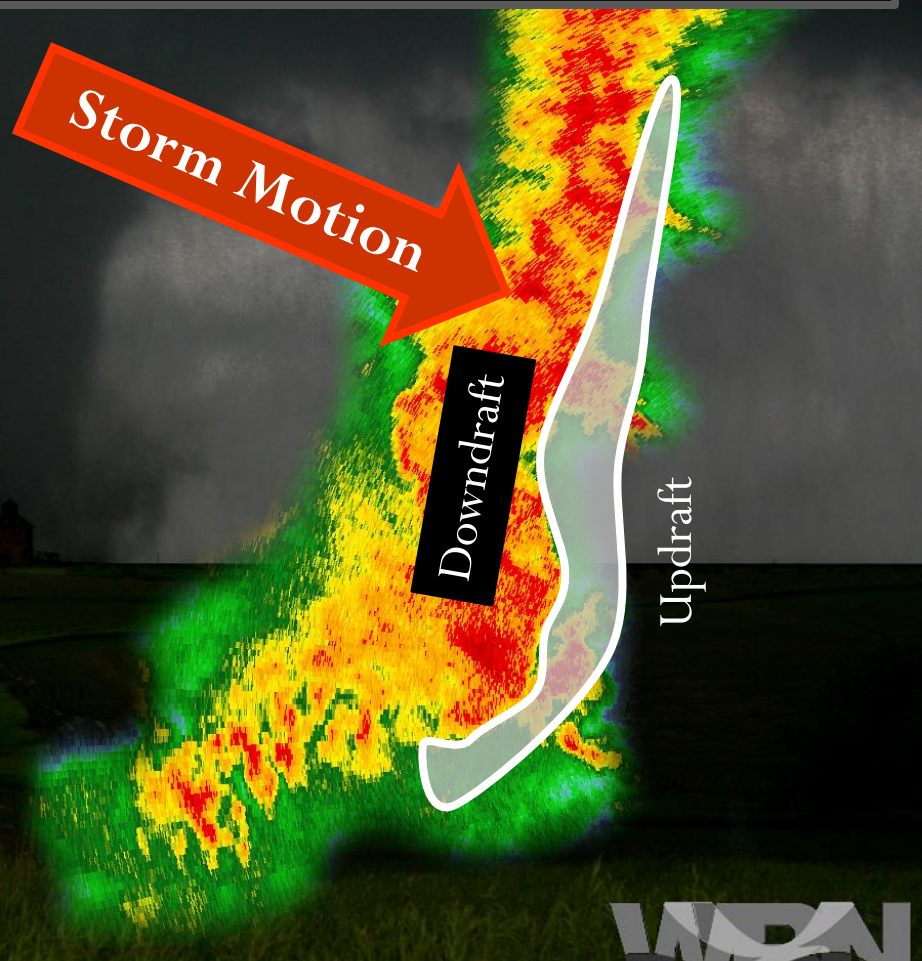
Updraft/Downdraft Summary



Rear Flank Updraft



Forward Flank Updraft





Updraft/Downdraft Summary



Rear Flank Updraft



Forward Flank Updraft



 **Hazard Zone:**
Tornadoes, Wind & Hail





Wall Clouds

Features of Strong & Severe Storms



Courtesy of Kevin Skow

- Isolated cloud attached to the bottom of the updraft
- Can be associated with both severe and non-severe storms
- Slopes downward toward the rain





Wall Clouds

Features of Strong & Severe Storms



Courtesy of Local5/WOI-TV

Signs of a Severe Wall Cloud

- Visible rotation and rising motion into the cloud
- Lasts for at least 10 minutes
- Strong winds rushing towards the wall cloud





Funnel Clouds

Features of Strong & Severe Storms



Courtesy of
Christine Hippen



Courtesy of Kevin Skow



Courtesy of
KCCI uLocal

- Narrow, tube-like cloud extending down from the base of a storm or wall cloud
- **Will be rotating**
 - Often smooth in appearance
- If the funnel circulation comes in contact with the ground, it becomes a tornado
 - Look below the funnel for swirling dust or debris as a tipoff that it has become a tornado





Tornadoes

Lifecycle

Locations in Storms

Variations

Falsenadoes

“A violently rotating column of air attached to a nearby shower or thunderstorm and in contact with the ground. A visible cloud or appearance of funnel is not needed.



NW of Lidderdale – May 10, 2015

Willard Sharp – intothameso.com





Tornadoes

Lifecycle

Locations in Storms

Variations

Falsenadoes

“A violently rotating column of air attached to a nearby shower or thunderstorm and in contact with the ground. A visible cloud or appearance of funnel is not needed.



8 W of Guthrie Center - May 9, 2016

Ricky McFarland





Stage 1: Development Stage

Tornado Lifecycle

S of Hardy, IA
June 16, 2014



Courtesy Jeff Halverson

Connection of dust whirl to a rotating wall cloud, a
funnel cloud, or cloud base





Stage 2: Mature Stage

Tornado Lifecycle

Belmond, IA
June 12, 2013



Courtesy Becky Ellington

Widening funnel,
vertically orientated

Funnel often extends
completely to the ground

Tornado is likely at its
strongest in this stage!





Stage 3: Dissipating Stage

Tornado Lifecycle



Belmond, IA - June 12, 2013

Courtesy Chris Miller

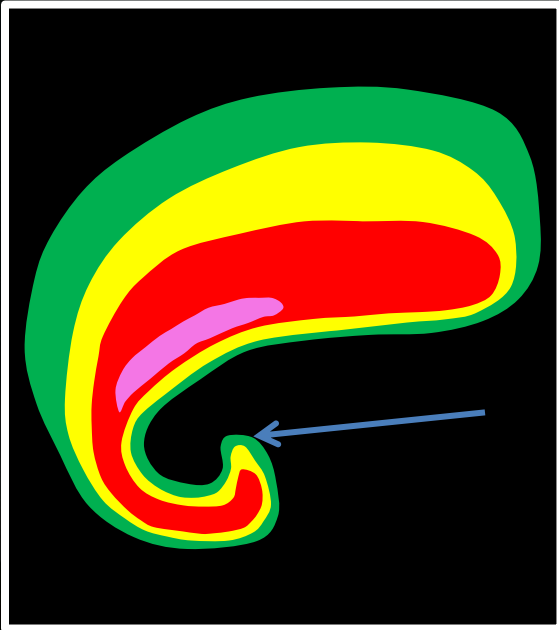
The funnel becomes a thin rope and then dissipates.
The tornado may still be very dangerous at this stage!



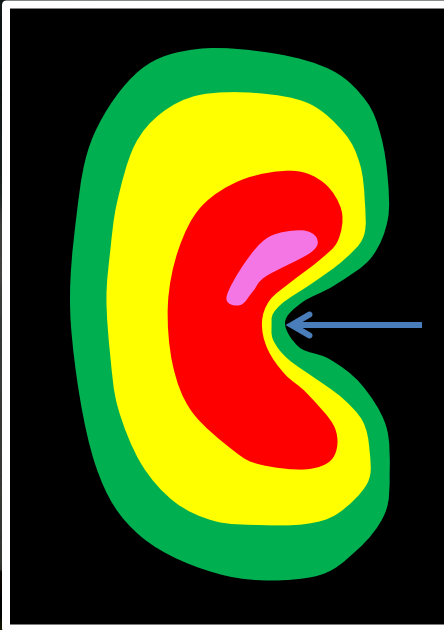


Tornado Locations in Storms

Rear Flank

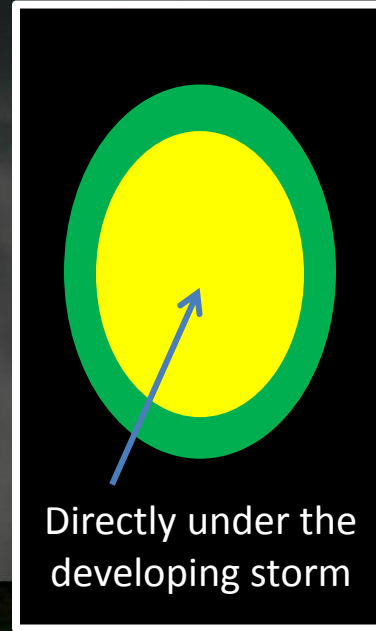


Forward Flank



HP Supercell

Centered



Directly under the
developing storm



Along the
leading
edge

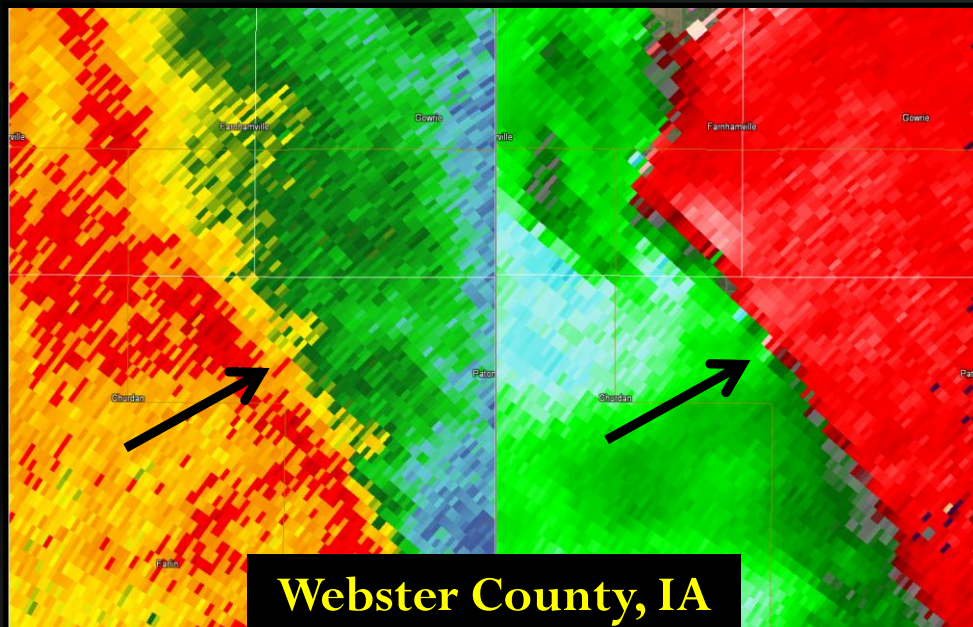
Squall Line

Bottom Line: Tornadoes can form in various locations,
depending on the storm type



Multi-Cell Line Tornadoes

Tornado Locations in Storms



Webster County, IA
August 31, 2014



- Tornadoes can form at the leading edge of squall lines (along the gust front)
- Often short-lived, but can still be damaging
- Tornadoes are rain-wrapped in many cases
- Can form very quickly and be difficult to detect on radar!



Single Cell Tornadoes

Tornado Locations in Storms

- Tornadoes with these storms are known as **landspouts**
- Form in the developmental phase of thunderstorms

Characteristics

- Little precipitation, no wall cloud, usually a thin funnel
- “Waterspouts over land”

Rake, IA 2011



Stuart, IA
July 6, 2014



Courtesy
KCCI uLocal

Often impossible to
detect on radar!





Tornado Variations



Courtesy Rod Donavon

Wedge Tornado
New Hartford, IA 2008



Courtesy KCCI uLocal

Cone-Shaped Tornado
Reinbeck, IA 2014

Wedge tornadoes tend to be intense. However, the strength of a tornado cannot be determined by observation!





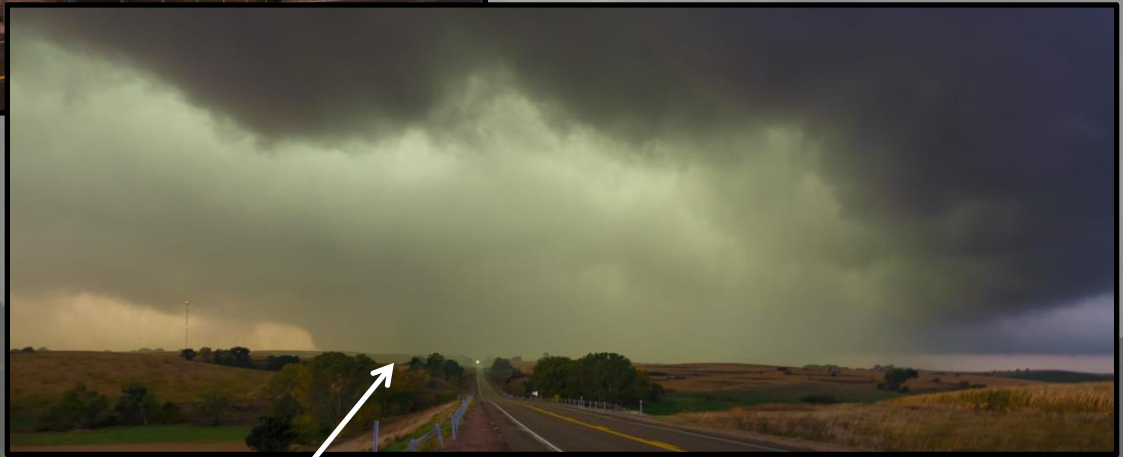
Rain-Wrapped Tornadoes

Tornado Variations

Photos Courtesy Kevin Skow



Merville, IA
October 4, 2013



Rain-wrapped tornadoes are often associated with HP
supercells and squall lines





Invisible Tornadoes

Tornado Variations



Courtesy Storm and Sky

Tornadoes do not always have a visible funnel!





Falsenadoes

Gustnadoes
Scud Clouds
Shelf Clouds
Dust Devils
Rain Shafts
Smoke Plumes
Towers
Grain Elevators

Nope, just a scud cloud





Gustnadoes

Falsenadoes



- Swirl of dust at the ground along the edge of a gust front
- Caused by winds surging out from a storm and is **NOT** connected to the cloud base, unlike a tornado
- Winds in a gustnado can still be strong and damaging



Gustnado or Tornado?

Falsenadoes

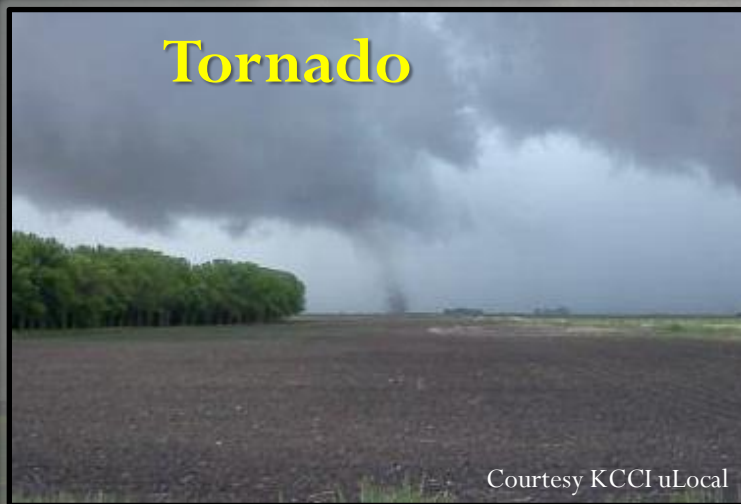
Gustnado



Both tornadoes and gustnadoes can form at the leading edge of a storm

The answer is not always clear cut!

Tornado



To tell the difference, **look at the clouds above the dust swirl.** If they are rotating as well, then you likely have a tornado.





Scud Clouds

Falsenadoes



Courtesy Jim Saunders



- Ragged clouds on the underside of a storm that are **NOT** attached to the main storm base
- Can resemble wall clouds, funnel clouds, and tornadoes
- Often short-lived and **do not** exhibit vertical rotation



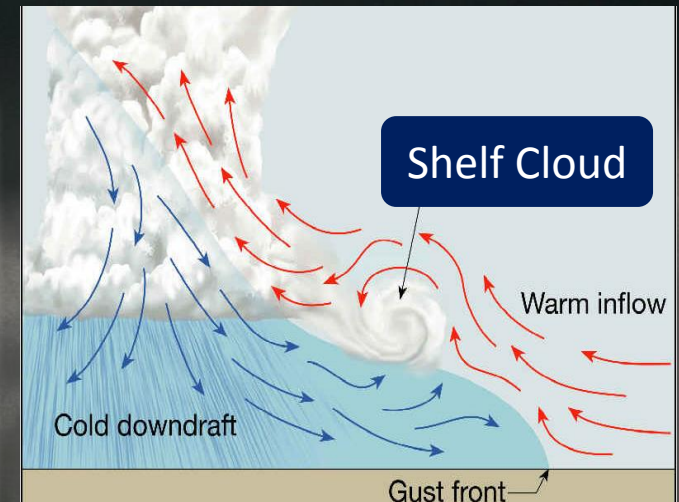


Shelf Clouds

Falsenadoes



Photos Courtesy Kevin Skow



- Long, flat cloud along the front of a storm (resembles a shelf)
- Slopes downward away from the rain
- Can be mistaken for a funnel cloud or wall cloud
- Rotates in the horizontal, but not the vertical!





Dust Devils

Falsenadoes



Courtesy Bryant Eakins



Courtesy Joshua Jergens

- Form on hot, sunny, summer days with light winds
- Can extend several hundred feet into the sky
- Winds are usually light and don't cause any damage





Rain Shafts & Smoke Plumes

Falsenadoes



Rain Shafts



Courtesy Andrew Revering

Smoke Plumes



Courtesy Dan Bush



<http://australiasevereweather.com>





Tornado Spotting Tips

Falsenadoes

If you are unsure:

Watch the feature for a few minutes and ask, “Is it...

- **Rotating** about a vertical axis?
- **Attached** to the cloud base?
- In the right **location** in the storm?
- Lofting **debris or dust**?



Courtesy NZP Chasers

If you answer “no” to any of these questions, then it is probably NOT a tornado!





Quiz



Wall Cloud or Shelf Cloud?



Funnel Cloud?

Tornado?

Scud Cloud?

Identify the features





Quiz

You Make The Call!

1. **Tornado**
2. Downburst
3. Rain shaft
4. Gustnado



Courtesy Whitey Anderson

It is tough to determine in real-time. Looping the video reveals weak rotation in the clouds above the dust swirl.





Quiz

You Make The Call!

1. **Tornado**
2. Downburst
3. Rain shaft
4. Gustnado



Courtesy Willard Sharp

Rain-wrapped tornado. Lower portion of funnel is invisible.

Video taken on November 11, 2015 West of Winterset





Quiz



Madrid, IA – Aug 4, 2016

Courtesy Willard Sharp/intothemeso.com

1. Scud Cloud
2. Wall Cloud
3. Shelf Cloud
4. Tornado



Courtesy KCCI uLocal

Shelf Cloud or Tornado?

Identify the features





Quiz

You Make The Call!

1. Funnel Clouds

2. Tornado

3. Scud Clouds

4. Shelf Cloud



Courtesy Kris Tuftedal





Quiz

You Make The Call!

1. Tornado

2. Funnel Cloud

3. Rain shaft

4. Gustnado



Courtesy Bob Lorraine





Quiz



Courtesy Willard Sharp – intothemseo.com



Courtesy Willard Sharp

How many Tornadoes?





Conclusion

What this Training Provided:

- Knowledge about how to spot severe weather and communicate what is seen to the NWS
- Awareness about the inherent dangers associated with severe weather spotting
- An understanding that the NWS does not officially deploy spotters and that spotters deploy at their own risk!



Conclusion

What this Training *Did Not* Provide:

- Any official certification – being a spotter is voluntary
- A license to break any law, **including traffic laws!**
- Any official affiliation as a National Weather Service agent or employee



The End!

Thank you for Attending
Have a SAFE year!

Voice: 800-759-9276 (800-SKYWARN)

Text: 515-240-5515

Email: dmx.spotterreport@noaa.gov

